Electrical World

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Transcontinental Telephony

A NOTEWORTHY accomplishment in telephone transmission over a distance of 3400 miles is recorded on page 279 of this issue. In many cases of electrical transmission increase in distance involves a change in magnitude but not in character of the problems to be solved. Such, however, is not true in telephonic transmission over wires, extra long distances giving significance to problems that can safely be ignored in short-distance work. Early attempts to overcome the difficulties encountered in extending the range of telephone lines were concentrated on the transmitting and receiving apparatus as a result of the belief that what was needed was transmitters of greater power and receivers of greater sensitiveness. That the limitation did not lie in the transmitter was demonstrated in a thoroughly convincing manner on Jan. 25, when Dr. Bell made use of an exact duplicate of his original transmitter to talk from New York to San Francisco with Mr. Thomas A. Watson, who had constructed the original telephone and heard the first words transmitted from it nearly forty years ago. Many improvements have been made in both the transmitter and the receiver, to be sure, but the really effective work in long-distance telephony has been that expended upon the line and its accessories. For directing attention to telephone transmission-line problems and finding solutions to some of them much credit is due to Dr. Pupin, whose "loading coils" are used in every long-distance telephone line properly so designated. For the solution of a very great many additional line problems credit must be given to the engineers of the American Telephone & Telegraph Company, of whom Mr. J. J. Carty is chief. To his untiring leadership in investigation, design and construction is to be credited the accomplishment recorded in this issue. Not one but many improvements, each adding its part and co-operating with the others, have contributed to the results obtained. Among the more important improvements upon which the engineering and financial success of the undertaking have depended have been not only the introduction of loading coils but also the substitution of copper for iron wire, the superposition of "phantom" and physical circuits, the simultaneous utilization of the line copper for telegraphy and telephony, and the development of satisfactory telephone repeaters—about which doubtless much will be heard later. Most noteworthy of all is the fact that the work of development has been accomplished under private ownership—a fact the significance of which will be more fully appreciated when one considers the results obtained in other countries under governmental ownership and operation.

A Chicago Commission for Chicago

GOVERNOR DUNNE of Illinois has suggested to the Legislature the creation of an ancillary commission to control public utilities in Chicago. This is a concession to the "home-rule" sentiment which sought a separate commission for Chicago when the Illinois commission law was enacted. The complaint is not that the State commission regulates utilities badly but that the city, jealous of its rights, should retain control over properties in its borders. The advocates of this policy feel that the city has satisfactorily settled electric-railway matters, regulated gas rates and adjusted relations with the electric central station. If this be granted, it still does not mean that satisfactory results would be secured in the future. When a city regulates, the vital rate-making power lies with the user of the service; the buyer decides what price he shall pay. A state commission, ideally directed, is unprejudiced and disinterested, acting fairly with regard to both buyer and seller. No one with knowledge denies that rigid regulation prevails in California, yet voters of that State have just placed all territory under the Railroad Commission. Previously large cities, except as they elected to have their utilities regulated by the State, kept the control themselves. The suggested action in Illinois represents a step backward.

Time to Begin

IN addressing the New England Street Railway Club Mr. Guy E. Tripp emphasized the statement made in the ELECTRICAL WORLD on Jan. 2, that our principal need is good home markets. He suggests that "it would help if we all agree that it is time to let up a little on conservatism and take some chances by beginning some of the work which is being held back." Central-station buying was curtailed last summer because securities could not be sold. Notwithstanding close money, a number of utilities sold sufficient securities even during the acute autumn to meet their needs. Buyers are now absorbing bonds, and money is much easier. Needed extensions and improvements can be financed better now than at any other time during the last six months. These conditions promote development. Business has lost heavily by apprehensions and fears, and it is time for the quiet, strengthening confidence which prevails to assert itself. To all classes the war has been a shock that will long influence buying habits. The lesson has been learned, however, and production is necessary to replace goods consumed during a half-year of uncertainty. To stimulate production slowly will be much more wholesome for buyers than to withhold orders until

skies are finally cleared, until manufacturing plants are in operation day and night, and until prices reach the top notch.

Rate-Making for Gas

The commercial success of electrical rate-making is pointing the way to the abandonment of flat rates for gas. A paper read by Mr. G. H. Cook, of Kenosha, before the Wisconsin Electrical Association and the Wisconsin Gas Association, contains the most recent plea for a change in gas rate-making. It cites the slow progress of Wisconsin gas utilities in five years as compared with electric utilities. The former increased 25 per cent in gross, the latter 80 per cent. Whereas in 1909 Wisconsin gas and electric utilities reported gross incomes of $4,000,000 and $4,400,000 respectively, five years later they showed respectively $5,000,000 and $8,000,000. The gas man is tempted to feel that if electrical utilities had not been in existence this great increment in revenue would have gone largely to his properties. Such a conclusion overlooks the highly diversified uses of electrical energy for which gas is neither adapted nor inviting and the commercial spirit and salesmanship in the electrical industry. The electrical industry has the impetus that comes from sustained success, and it can encourage better rate-making in gas utilities.

Radio Antenna Constants

Many experimenters in radiotelegraphy have been sorely puzzled by observation of a change in antenna capacity when measured according to the usual methods. By exciting an aerial system at two different wavelengths and calculating its capacity, inductance and natural frequency from the data thus secured, it is always found that the numerical values obtained vary considerably when the pair of chosen excitation frequencies is changed. The common impression has unfortunately been, it appears, that this variation is due to a difficulty in making accurate measurements; in general the instruments used have been distrusted, rather than the method.

In an interesting article in this issue Mr. Louis Cohen develops a mathematical proof of the cause of these measurements' deviations from absolute values. When the inductance and capacity of a radiating antenna are properly considered as distributed quantities the hiatus at once vanishes, and it becomes possible to assign definite values to antenna constants and to determine the variation in resulting resonant frequency as the ratio of lumped to distributed inductance is changed. The mathematical treatment of an antenna according to the practice of transmission-line calculation is worthy of note and extension. The present numerical relations are applied to aerials in which the capacity and inductance—except the inductance of the loading coil—are ideally distributed. To consider the existing radiating structures, in which the distribution of capacity and inductance is usually different in the vertical and approximately horizontal sections, would, of course, further complicate the problem. It is hoped, however, that in spite of its evident difficulty, a more general solution will be attempted and presented to the radio-engineering profession before long.

It should be noted that when comparatively large loading coils are used in the resonant determination of antenna constants the agreement of observed results on the assumption of lumped quantities and those calculated from the expressions stated by Mr. Cohen is quite good. Thus for the ordinary determination of antenna capacity it is not necesssary to resort to complete computation, though without doubt radio engineers will find it interesting to check their physical measurements against the values calculated from the relations given in Mr. Cohen's article.

High-Tension Underground Transmission

As our readers are well aware, the overhead transmission line as used in general practice here is viewed with some suspicion by foreign engineers. Of course, many high-tension overhead lines are in use on the Continent, but there is a strong tendency to use underground service as is well exemplified in a paper by Mr. H. Henney abstracted in the Digest. The case described is that of the City Electricity Works of Trier on the Moselle. These comprise a well-ordered modern steam station with turbine equipment and a water-power plant on a tributary of the Moselle about 15 miles from the city. Of the steam station little need be said except that it is a type not uncommon here. The water-power station, which operates under a somewhat variable head of nearly 100 meters, contains three three-phase generators, each rated at 1870 kva, 5500 volts and fifty cycles per second, with room for a fourth set of similar character. The generators are directly coupled to Francis type turbines in spiral housings rated at 2000 hp each. The station represents an excellent example of hydroelectric construction in no wise radically different from plants familiar in this country.

The striking point about the system is that the main transmission line consists of an underground cable, connecting directly with the 25,000-volt city distributing system. There is also an overhead line which can be used as a reserve but which presents no special features. The cable used for this transmission is of the three-wire, paper-insulated type, consisting of three seven-strand conductors each of 35-sq. mm cross-section individually insulated with paper 14 mm thick laid together in insulating material and again laid with paper, over which is a lead covering. Outside of this is a layer of paper and jute, surrounded by a steel armor which is itself served with jute on the exterior. This cable was tested for half an hour at 75,000 volts, three-phase, fifty cycles. When tested for dielectric loss it showed only about 250 watts per km. This cable equipment, which has been in very successful use for a year, appears to have fulfilled all requirements. It is buried 3 ft. underground in a trench, with a telephone cable laid about 8 in. from it. This transmission is a first-class

example of the work recently accomplished on the Continent in underground transmission. It is rather expensive and hence does not particularly appeal to engineers in this country, but it gives good evidence of the practical effectiveness of such a transmission system when required.

The Temperature of the Arc

In the Digest appears an abstract of an exceedingly important report on the melting of carbon and the temperature of the arc, based on experiments by that past-master of the photometric art Prof. Otto Lummer. It has been long believed that the crater of the electric arc reaches for a given pressure a maximum temperature which corresponds to the boiling point, so to speak, of carbon. Above this no further excess of energy supply seems to be able to raise the temperature. On this principle is based the use of the crater of the arc for a photometric standard in connection with a suitable screen for cutting off everything except the middle of the crater. This standard light source, which was suggested by Blondel more than twenty years ago, was discussed at some length in a paper before the British Association for the Advancement of Science at its 1913 meeting. Professor Lummer has made an extended investigation of the subject, using his interference pyrometer as a measuring instrument.

The most interesting portion of the research deals with the variation of surface brilliancy of the crater with the pressure in the surrounding medium. As a starting point, so to speak, Lummer found that the steady temperature of the pure carbon arc at normal atmospheric pressure is 4200 deg. absolute in the positive crater, the extreme temperature which is reached in the negative electrode being probably 100 deg. less. He found also that the arc radiates, like the carbon incandescent filament, as a "gray body," so that the temperatures can be expressed from the photometric brilliancies in the form of a simple exponential equation. By experimenting at pressures of from 1 atmosphere down to 0.1 atmosphere he found an extreme difference from 4200 deg. absolute down to 3900 deg. absolute. For 0.1 atmosphere difference in pressure below normal the decrease in brilliancy was only 1 per cent. From this it is obvious that in using the arc crater as a photometric standard the barometric correction would be practically negligible. Carbon does not lend itself readily to extreme pressures in suitable formation of the arc, and, following the matter up with impregnated carbon electrodes to give a proper arc stream at high pressures, Lummer was able to reach at 22 atmospheres pressure twenty-three times the surface brilliancy of the normal arc, and a temperature which he estimated at 6090 deg. absolute on the assumption that the impregnated carbon electrodes used by him gave a "gray-body radiation" so far as the crater was concerned. It is the possibility of reaching such extraordinary temperatures which lends the greatest interest to Professor Lummer's research, since this maximum temperature is practically that of the solar service as nearly as it can be ascertained from the character of its radiation assumed as that of a "black body"—which it probably is not. However, in spite of the necessarily hypothetical matters thus introduced, there is good reason to believe that Professor Lummer has reached experimentally temperatures quite comparable with that of the sun. In any event he has developed a method which will enable the character of the radiation from vapors to be investigated at a temperature approximating solar conditions, although burdened with pressure conditions which somewhat complicate the situation. From whatever aspect it is viewed, the research is a most important one.

A Network for Small Consumers

Many readers interested in central-station developments will find much worth considering in the description of the work done by the Central Illinois Light Company in the reorganization of its system, the center of which is in Peoria, Ill. The network now connected extends about 55 miles east and west and perhaps half this distance north and south, supplying electrical energy to twenty-seven cities and towns, with an aggregate population of about 140,000. The chief station now contains 10,500 kw in turbo-generators and two engine-driven sets aggregating 1400 kw. Some very practical changes in the steam generating plant were necessary in reconstructing the main station. A revolution in the supply of condensing water became necessary. As finally arranged, many piping complications were suppressed, and the water is delivered by five circulating pumps, any or all of which can be used as the load and temperature of the circulating water varies.

The transmission system is operated at 13,000 volts and 6600 volts, and provision is made for operating at 33,000 volts when necessary. The problem in transmission which confronted the company was that of supplying energy economically to many small communities. A large part of the line is carried on wooden poles of standard type 35 ft. in height spaced 135 ft. apart. Through the suburbs of Peoria the transmission lines are carried on angle-iron extension tops borne by the poles of the distributing system. At one point a series of deep gullies presented almost insuperable difficulties in the construction of a wooden-pole line and use had to be made of tower construction. The towers are not of the ordinary kind, being merely 30-ft. flexible A-frames placed at the high points between gullies, over which are spans of from 400 ft. to 800 ft. At the longer spans the A-frames are guyed back and forward to afford extra resistance. Rural service is an important feature of the system. Transformers for this service are operated mostly at 6600 volts primary, with the secondaries at 220 volts for motors and 110 volts for lighting. It has been found by experience that the average rural customer in this territory yields something like $30 a year in revenue. Being sufficiently numerous, the rural customers represent no inconsiderable addition to the service of a system which deals, in the nature of its work, especially with small loads.

LETTERS TO THE EDITOR

National Electrical Week

To the Editor of the ELECTRICAL WORLD:

SIR:—I, personally, think the possibilities indicated by the plans affecting an "electrical development week" are most inspiring. One kind of co-operation makes a revolution; another kind of co-operation makes a war. Our kind of co-operation can make a real war on darkness and a revolution in our living. Let's have a hundred million people in this conflict.

L. D. GIBBS,
Superintendent Advertising Dept. the Edison Electric Illuminating Co. of Boston.
Boston, Mass.

To the Editor of the ELECTRICAL WORLD:

SIR:—In answering your note concerning the proposed "national electrical week," it occurs to me that possibly the celebration, if carried out in October, would conflict with the growing recognition of "Edison Day," which is also an October event. I should think it would be difficult to carry any kind of industrial or commercial celebration through an entire week. If in the judgment of those who are behind the movement, however, the "electrical week" idea should prevail, would it not be better to substitute one of the earlier months of the year?

ARTHUR WILLIAMS,
General Inspector New York Edison Company
New York, N. Y.

To the Editor of the ELECTRICAL WORLD:

SIR:—I take great pleasure in approving the proposed "electrical week" and will place the Ohio Electric Light Association at the disposal of the electrical interests of the State to make such an occasion a success.

Not only do these things occasion an increased use of electricity, but I believe the most crying need of the present day is the education of the people not only upon the uses and advantages of electricity, but about its distribution and disposal. I think we have suffered greatly because the nature of electricity is so little known. The average person with whom we do business looks upon the whole subject as one of mystery, and naturally with suspicion, knowing nothing about it. If we can educate people not only as to its advantages but also as to its cost, generation and distribution, I believe it will be a good thing for those who are engaged in central-station work.

D. L. GASKILL,
Secretary Ohio Electric Light Association.
Greenville, Ohio.

To the Editor of the ELECTRICAL WORLD:

SIR:—The proposed "national electrical week," as referred to in your issue of Jan. 16, will, I believe, meet with a hearty response from central-station men, and the Society for Electrical Development is deserving of much commendation for this most excellent suggestion. The success which has attended special electrical days and electrical weeks, as accomplished by individual companies, indicates in a small measure at least the tremendous advantages which will accrue to the entire industry if all of its component parts unite in one grand effort to drive home the slogan "Do it electrically." Our experience with special days of this nature in the past leads me to believe that much greater returns will be obtained from the large sums of money which will be spent in advertising if price reduction either on an entire line or on certain specialties in the line be offered by each manufacturer during this week as far as possible. Unless the public can see some concrete advantage in the way of a price reduction on the commodities offered, it is much more difficult to attract its attention, arouse its interest and induce it to buy. As every new appliance sold becomes a center of disturbance from which waves radiate in all directions, thus selling several additional appliances at the regular price after the special campaign is over, we believe the price reduction during the special week is fully justified.

I am quite sure that central stations everywhere will heartily welcome this most commendable move and co-operate with all of the other branches of the industry in making it a huge success.

BAYARD W. MENDENHALL,
Commercial Agent Utah Light & Traction Company.
Salt Lake City, Utah.

To the Editor of the ELECTRICAL WORLD:

SIR:—In answer to your note I should state that the idea of a "national electrical week" is naturally very attractive to those interested in the commercial activities of our industry. Any effective means of exploiting the advantages of electric service, and of increasing the sale of electrical energy and of electrical merchandise, is highly commendable.

The publicity that would attend a "national electrical week" could not fail to be of advantage in developing increased interest in our product. In striving for such a celebration two questions arise:

First—*What* are we going to celebrate?

Second—*How* are we going to celebrate?

It will be easier to pass intelligently upon the advisability of holding such a week after some of the plans have been elaborated in detail. Many of the suggestions made as to the promoting of the plan, as noted in your article, are excellent; but it seems to me that we must specifically decide upon one definite thing to celebrate and specifically advertise that one thing. To define the activities of many things without some specific idea would not, in my opinion, result in any material gain.

T. I. JONES,
General Sales Agent Edison Electric Illuminating Company of Brooklyn.
Brooklyn, N. Y.

To the Editor of the ELECTRICAL WORLD:

SIR:—The suggestions made as to the ways and means of promoting the plan of a meeting held in New York on Jan. 8 seem to indicate quite an interest in the subject evidenced by those present, but it would appear that something more distinctive than a general hurrah on the subject for a week should be our aim if the plan goes through. It will hardly be practicable to get the co-operation of city authorities, boards of trade, chambers of commerce and civic organizations in this effort, and I am afraid we are aiming too high.

The electrical trade or the utilities are no more entitled to such recognition than any other line of trade would be. The inauguration of "white way" lighting and similar attractive displays throughout the country during that week will result in creating material interest, but whether or not this will bring additional business in proper relative proportion to the expense is, of course, again the question.

The electrical industry or business is not as a whole one of seasons. Truly, our lighting period commences in October and extends throughout the winter. On the other hand, this does not mean any increased activity or the employment of more help, nor is it in any way comparable with the activity at certain seasons in other commercial lines of business. For this reason I question whether the outlay and the effort of one week along the

liberal lines proposed will be conducive to the results in proportion to what could be accomplished by continuous activity spread over the entire year.

However, we are always in a receptive mood for any and all suggestions along this line, and should the plans work out and the consensus of opinion be favorable you will not find us missing if we can see our way clear to say "present."

A. C. EINSTEIN,
Vice-president and General Manager
Union Electric Light & Power Company.

St. Louis, Mo.

To the Editor of the ELECTRICAL WORLD:

SIR:—I consider your article on the "National Electrical Week" most interesting and timely. I am quite sure the result from this article will be surprising. I assure you of my best efforts and earnest co-operation to make the "electrical week" a great success.

JOHN R. GALLOWAY.
President National Electrical Contractors' Association.

Washington, D. C.

To the Editor of the ELECTRICAL WORLD:

SIR:—To me the idea of a "national electrical week" is one having wonderful possibilities in stimulating the growth of the industry in which we are so much interested. That it is an immense undertaking and one that entails a large amount of work there is no doubt whatever. However, it is, I believe, just such a big movement, properly planned long enough ahead of time, that will enable every organization in the electrical industry to contribute the best ideas and the greatest amount of substantial hard-working co-operation, the results of which cannot fail to be far-reaching and most beneficial.

It seems to me that the national electrical week presents a splendid opportunity to visualize the actual results of a national co-operative effort made in accordance with the well-known Jovian slogan, "All together, all the time, for everything electrical." We hear "electrical sermons" preached from this text time and time again; now here is a chance to show our faith by our works.

Imagine, if you will, every city and town from Maine to California in a holiday attire of illuminated streets and stores for a whole week, the store windows being attractively dressed, festoons of lamps and other decorations being properly installed, the civic authorities brought in line, and all other interests in the city stimulated to join the "light brigade." What will be the result? People will be living, for the week at least, in an electrical atmosphere, thinking and talking of things electrical, which must necessarily prompt their use. The result will be far-reaching; the discussion among the women of electrical dishes easily and economically prepared can but lead to an exchange of ideas on this subject, resulting in an increased use of the devices themselves. The suggestion alone of the progress made by the industry will be worth much because it will popularize the subject, causing it to be discussed pro and con by the people at large.

Then consider the merchant who has been induced to participate. Possibly he has never before been brought to see the advantage of properly illuminating his windows and store. He will undoubtedly be so much impressed that it is hardly possible that he will desire to return to a poorly lighted store, less attractive and interest-compelling. Even a week will be sufficient to teach many a merchant the error of the way he has been pursuing.

The town as a whole should receive an inspiration for brighter things that will be lasting, because as a result of a concentrated effort it will be transformed in the twinkling of an eye to a city of beauty, which the citizens, once they have grasped its advantages, will want to make a "joy forever."

In any event the industry as a whole is bound to receive a stimulus from such an effort, and, like "clean-up day" practised in so many cities, once we see ourselves as we should like to be seen, we shall wonder how we could ever have been satisfied with our previous condition.

However, let us not lose sight of the fact that such an undertaking means work, hard work, and lots of it. It will mean co-operation, and that of an unusually unselfish kind, and lots of it. It will necessitate frequent conferences all over the country and careful planning, because it should not be undertaken unless it can be carried through with the certainty of a successful conclusion.

The electrical industry has too much at stake to risk a failure, but it will not fail if we all put our shoulder to the wheel, and we may rest assured the more we put into it, the more we shall get out of it.

There is so much work for each of us that each should begin early to plan, making such plans harmonize closely with the branches of the industry. Plans can be made long in advance for securing the co-operation of the merchant, how his window can be brightened, how his store can be made more attractive, how the streets can be better lighted, and hundreds of other suggestions that will readily occur once we get started. But to delay this would be fatal because of the special work to be done at the last minute, and, incidentally, the simpler the wiring plans the greater the success of the undertaking.

Summing up, then, here is a magnificent opportunity for showing the public in an effective, practical manner the advantages to be gained from an increased use of electricity, for the unqualified success of which we must have the unselfish assistance of every branch of the electrical industry.

J. C. MCQUISTON,
Manager Westinghouse Department of Publicity.

Pittsburgh, Pa.

To the Editor of the ELECTRICAL WORLD:

SIR: If the manufacturers, jobbers, central stations and contractors would all "work together," a "national electrical week" could be made a grand success. I am for it.

ERNEST FREEMAN.
President Freeman-Sweet Company.

Chicago, Ill.

To the Editor of the ELECTRICAL WORLD:

SIR:—The idea of a "national electrical week" is most excellent. It seems to me, however, that we could choose some better date than the week of Oct. 18. The history of lamp sales indicates that this week falls during the peak of greatest lamp sales. That is, this period is the peak of the season's business of the whole electric-lighting industry. It seems to me that we should celebrate "electrical week" at an off-peak date, when we shall all have a little more time to attend to it and when the stimulation which will result therefrom need not further burden our facilities, which in this particular year will probably tax our resources to the greatest extent in our history.

To explain the remark just made I would say that I have heard enough comment from our central-station friends to indicate that the connected load is increasing all the time and that it is going ahead this year, while the maximum demand is not, and that consequently the ratio between the connected load and the maximum demand is so changing that were the industry suddenly to celebrate by utilizing a larger percentage of its con-

nected load, even though it utilized no greater percentage of the connected load than would be predicted from past history, we should find ourselves embarrassed rather than benefited by the "national electrical week," simply because we chose a peak period for its observation.

It seems to me that if we are to have such a week we should select the middle of August or the latter part of January, which are off-peak periods of the year's activities.

S. E. DOANE,
Cleveland, Ohio. *Chief Engineer National Lamp Works of General Electric Company.*

To the Editor of the ELECTRICAL WORLD:

SIR:—Concerning the proposed "National Electrical Week," my idea is that the concentration of thought on things electrical for one week by the millions of buyers in the United States will not only tremendously increase the sales of electrical devices, appliances and materials for that week but will leave a lasting impress on the minds of the consumer everywhere that the one best way is to "do it electrically."

GEORGE H. DUFFIELD,
Utica, N. Y. *Secretary National Electrical Contractors' Association of the U. S.*

To the Editor of the ELECTRICAL WORLD:

SIR:—I heartily favor the idea of a "national electrical week," believing that a concentration of effort along well-directed lines will create a profound impression upon the general public, followed by an increased use of everything electrical.

My first impression was that an "electrical week" in the spring of the year would result in a more substantial benefit to the industry than a week in the fall, but upon reflection I have come to the conclusion that October is, after all, the best month in the year, because then the days are getting shorter and everyone's thought is naturally turning to light, and as electric light is the best, so it is easy to carry the mind to some extent to the use of the best light and the use of the most convenient and efficient devices.

W. E. ROBERTSON,
Buffalo, N. Y. *Robertson-Cataract Electric Company.*

To the Editor of the ELECTRICAL WORLD:

SIR:—Referring to your article entitled "A National Electrical Week," in your issue dated Jan. 16, I heartily approve the plan to stir up the public in the matter of better lighting. The idea of enlisting the co-operation of the Jovian Order is certainly a novel one. The Jovians have been looking for something to do that was worth while ever since they were organized, and I feel sure that if an opportunity is given to them, under proper direction, most effective work will be done by them.

CHARLES L. EIDLITZ,
New York, N. Y. *President Metropolitan Electric Manufacturing Company.*

To the Editor of the ELECTRICAL WORLD:

SIR:—Concerning the subject of "A National Electrical Week," as covered in an article in your issue of Jan. 16, incidental to a meeting of prominent electrical men held Jan. 8 on the invitation of the Society for Electrical Development, it is almost needless for me to say that I am heartily in favor of a movement of this character and believe that it possesses large possibilities if properly organized and promoted, inasmuch as the basic principles of the thought were first given voice by the Commercial Division of the Jovian Order in its annual report made last October and in the issue of *The Jovian* which was mailed to subscribers on Dec. 28.

In that issue, under the editorial caption "Capitalizing Opportunity," the idea is promulgated in the following words:

"In this issue we describe at some length the clever plan adopted by our Chattanooga Jovians to capitalize the publicity given Edison Day. They backed up a national advertising campaign with a specific, local campaign having commercially valuable features, thereby securing the advantage of the cumulative effect of the national work, which without such crystalized, concrete, local backing loses much if not all of its commercial value, except from the standpoint of general publicity—a most indefinite reward.

"We have had some thoughts along this line in connection with our own 'Jovian Day,' or some other day which can be set up by the society and on which, following national publicity, concentrated effort shall be made in each city. This may be in the form of special sales at all electrical retail stores, exhibitions, parades in connection with the electric-vehicle association and other organizations, co-operative advertising, and a variety of other methods tending on this special day particularly to call to the attention of the entire nation the convenience, economy, safety, cleanliness and efficiency of electricity in all its applications.

"In Buffalo they attempted something of this nature by co-operative advertising just preceding Christmas. The manner in which this was prepared in our opinion is far superior to the usual method of making up co-operative pages. It will be interesting to note what actual results are traceable to this effort.

"If a plan of that character is practical and profitable, followed in each locality in connection with other methods of attracting attention within the power of our local organizations, we can see the possibility of each year, or twice each year, putting over a big commercially profitable scheme at a very small expense by using the machinery of the order."

In the above paragraph, referring to the efforts of Buffalo Jovians, the Commercial Division conveyed the thought that not only special "electrical days," inaugurated by national advertising and made commercially profitable by concentrated local effort, are possible, but the cumulative value of all the national advertising and effort that is expended to instil into the minds of the public the desire to "make it an electrical Christmas" could also be capitalized by local "follow-up" work during the holiday season.

The Society for Electrical Development should be congratulated upon its alertness in adopting the electrical day suggestion, and in somewhat broadening its scope by lengthening the period of contemplated activity from several days during different months to one week each year, although it is more than probable that in addition to the "electrical week" the same plan would be profitable for a period preceding Christmas, as above noted, with little more advertising nationally than would be given in any event to the greatest of all the open-pocketbook times.

That central stations, manufacturers, jobbers, dealers—the entire industry—will be a unit in working for the success of a movement of this kind, provided the organization actively promoting the plan is in a position to enlist earnest, enthusiastic and, most important of all, organized local effort throughout the whole United States, cannot be justly doubted.

In brief, in my opinion, it is difficult to picture failure for the idea if competently handled by a body commanding widespread, organized, local co-operation, but even more difficult to visualize success without that absolutely essential element.

ELL C. BENNETT,
St. Louis, Mo. *In charge central offices of the Jovian Order.*

Inauguration of Transcontinental Telephony

Impressive Demonstrations at New York, Boston and San Francisco Mark the Beginning of Oral Communication Between the Atlantic and Pacific Coasts

ELABORATE ceremonies marked the formal opening of telephone service between the Atlantic and Pacific coasts on Jan. 25, when Dr. Alexander Graham Bell, the inventor of the telephone, talked from New York to San Francisco, 3400 miles away, to Mr. Thomas A. Watson, who constructed the first telephone instrument in 1876 under Dr. Bell's direction. During the conversation between these two men use was made of an exact reproduction of the original transmitter as built by Mr. Watson and used by Dr. Bell to speak to him in an adjacent room at No. 5 Exeter Place, Boston, on March 10, 1876.

Over the transcontinental line, 3600 miles in length, other distant point—Jekyl Island, off the Georgia coast.

In addressing the persons assembled in New York to witness the first formal demonstration of transcontinental telephonic communication, Mr. Union N. Bethell, president of the New York Telephone Company, stated that in round numbers the Bell system today includes 9,000,000 subscribers' stations joined together by 21,000,000 miles of wire at a total cost of $850,000,000. In the employ of the associated telephone companies are 160,000 men and women, giving service in 25,000 cities and villages and 60,000 railroad stations. The average load on the system is 26,000,000 messages per day. In San Francisco and New York

DR. ALEXANDER GRAHAM BELL

MR. THEODORE N. VAIL

DR. MICHAEL I. PUPIN

MR. JOHN J. CARTY

PERSONS PROMINENTLY IDENTIFIED WITH AMERICAN TELEPHONE DEVELOPMENT

spoke also President Wilson from Washington, D. C., to President Moore of the Panama-Pacific International Exposition in San Francisco. Greetings were also exchanged between Mayor Rolph in San Francisco and Mayor Curley in Boston and Mayor Mitchel in New York. To all of these conversations and many others between public officials and engineers of the telephone company in Boston, New York and San Francisco President Theodore N. Vail of the American Telephone & Telegraph Company was an interested listener at an-

there are 685,000 telephone stations, which number is larger by 50,000 than the number in London, Paris, Berlin, Vienna, Brussels, Amsterdam and Petrograd combined, although their population is three times that of New York and San Francisco.

In the development of the Bell telephone system of the United States, which now serves to connect the extreme East with the extreme West, there has been expended twice as much money as on the Panama Canal—the water route which connects the East and the West.

Mr. Bethell stated that to no one man could credit be given for the work of development culminating in the transcontinental telephone system, but he called attention to the excellent service rendered by Mr. J. J. Carty, chief engineer of the American Telephone & Telegraph Company, who during his thirty years of association with the company has contributed more than any other one man toward the development of the Bell system, having made many valuable inventions and standardized the methods of construction and operation.

On being presented to the assemblage, Mr. Carty said that the original Bell-Watson telephone transmitted speech over the 3400-mile circuit to San Francisco with greater clearness than was possible over the first "long-distance" line of two miles between Boston and Cambridge, Mass., over which the first conversation took place on Oct. 9, 1876. He stated that a great many minds have worked together to bring about this result, and claimed that honor should be bestowed on every person who had contributed his share to insure the success of the undertaking.

Mr. Carty remarked that the Bell system is watched over continuously by 1200 men, any one or all of whom can be commanded from a room at 15 Dey Street, New York. The forces are so arranged that the most inaccessible point anywhere on the three line fronts can be reached in less than two hours. With few exceptions, almost any part of the line or a particular part

FIG. 1—ROUTES OF TRANSCONTINENTAL LINES

of this great length of circuit, and all of the apparatus, can instantly be reached by an engineer, line man or cable man. The preparations are made to move one man or a gang. All means of conveyance are employed, from snowshoes to automobiles. These include saddle horses for inaccessible mountain regions where roads are found to be bad, automobiles, motorcycles and wagons drawn by horses. Any one of this large force of people can instantly be reached from the Dey Street headquarters, and the whole force, spread out over twenty-five states, is under perfect control, from one point.

The work of completing the last link of the transcontinental line from Salt Lake City to San Francisco consumed only two years, but in the system as actually installed have been embodied numerous improvements made during many years. Since Dr. Bell produced his first telephone there have been introduced seventy-three different transmitters, fifty-three of which have appeared since 1877. Moreover, switchboards, metallic circuits, hard-drawn copper wire and "loading coils" have all been developed especially for the transcontinental service. Progress in long-distance telephony is strikingly shown by the accompanying table.

Among the improvements to which the success of the transcontinental telephone service must be attributed, not the least important is the use of the so-called "loading coils," the invention of Dr. Michael I. Pupin, of Columbia University. In the form actually utilized the coils differ markedly in mechanical details from the loading coils first built. The earlier coils were as large as nail kegs, whereas the present coils are from 4 in. to 5 in. in diameter. They vary in size with the character

PROGRESS IN TELEPHONE TRANSMISSION

Year	Distance in Miles	Terminals
1876	2	Boston–Cambridge
1882	45	Boston–Providence
1884	235	New York–Boston
1892	900	New York–Chicago
1911	2100	New York–Denver
1913	2600	New York–Salt Lake City
1915	3400	New York–San Francisco

of the line in which they are placed. There has been developed for use in the core of the coils insulated iron wire 0.004 in. in diameter, of which 13,600 miles is used in the coils erected in the New York-San Francisco line.

Between New York and San Francisco there are now being operated two physical telephone circuits and one phantom circuit. The physical circuits are formed of hard-drawn copper wire of No. 8 B. W. G. 0.165 in. in diameter. The total weight of the four 3400-mile copper wires in use between New York and San Francisco is 5,920,000 lb. These wires are mounted on a total of 130,000 poles. Not over ten miles of the circuit is in underground cables. It is estimated that when a conversation is being carried on over the 2400-mile line equipment valued at $2,000,000 is "tied up" temporarily for this service. However, sight should not be lost of the fact that three conversations can be carried on simultaneously between New York and San Francisco, while several telegraph messages can be sent at the same time over portions of the wires. When the line was extended to Denver in May, 1911, nine intermediate conversations could be carried on simultaneously over various parts of the system and twenty-eight telegraph messages could be sent simultaneously. In the Denver-San Francisco link the circuits are arranged for "phantom" operation, and similar superposition can be accomplished.

A noteworthy feature of the demonstration on Jan.

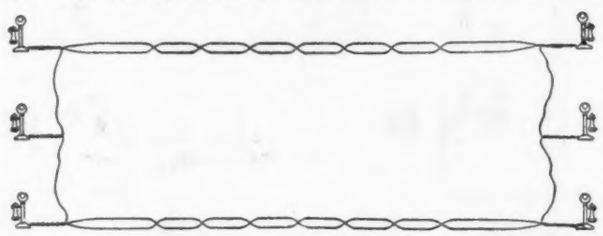


FIG. 2—ARRANGEMENT OF PHYSICAL AND PHANTOM CIRCUITS

25 was the simultaneous utilization of numerous telephone receivers at the seaboard terminals for the benefit of persons invited to listen to the conversations carried on between New York and San Francisco. This result could have been achieved only by means of relays, to which beyond doubt much of the success of the long-distance telephonic transmission must be attributed.

Electric Service In and Near Peoria, Ill.

Reconstructing a Generating Station During Continuous Service and Solving Transmission Problems of the Central Illinois Light Company

HAVING rebuilt its former generating station at Peoria, Ill., and extended its transmission system to cover the greater part of five counties, the Central Illinois Light Company is delivering twenty-four-hour electric service to twenty-seven cities and towns. Chief among these is Peoria, the headquarters of the company. Reaching out from this center, high-tension lines of the company extend approximately 55 miles east and west, and the lateral territory covered is about one-half this width at its broadest point. The total population of the district within which the company operates is 140,000.

Rebuilding the Old Station

In reconstructing the generating plant practically no changes were made in the coal-handling equipment. The 1-ton grab bucket driven by a three-phase motor still lifts the coal from the cars and delivers it into the bunkers over the firing aisle. Ashes from the grates are raked and shoveled into cars operating on the track beneath the firing-aisle floor and are dumped into a pit beneath the grab-bucket structure. From here they are lifted into cars at such times as the coal-handling equipment is not otherwise occupied.

Changes in the boiler room itself were slight, the main feature being the addition of four 570-hp Geary boilers made by the Oil City Boiler Works. These, with the ten 300-hp steaming units of the same type which had been previously installed, bring the total boiler rating of the station up to 5280 hp. The new units and all but two of the old units are equipped with Green chain-grate stokers. Two boilers were never equipped with stoking apparatus, as it was thought that hand-firing made them more efficient for meeting sudden peak-load demands. The 300-hp and the 570-hp units are set respectively 5 ft. and 7 ft. above the ground level. In every case the boilers are horizontally baffled.

In burning Illinois coal on the chain grates a considerable quantity of water must be added. This is supplied from a perforated pipe running along the face of the boiler just above the stoker hopper. A Sturtevant economizer with 10,756 sq. ft. of heating surface was installed in connection with the two banks of larger boilers. The multivane exhaust fan used in connection with this unit is driven by a 12-in. by 14-in. throttling steam engine.

Natural draft for the furnaces is supplied by two stacks. One of these, a steel stack, measures 185 ft. in height and 9 ft. in diameter, while the other, a concrete structure, is 200 ft. high and 13 ft. in diameter.

On account of the fact that a considerable portion of the exhaust steam is used in the exhaust-steam heating system the percentage of make-up water required is high. Water taken directly from the Illinois River behind the station is treated for hardness in the company's Kennicott ground-operated water softener. Soda-ash and iron sulphate are the principal chemicals used in the softener. The capacity of the purification plant is about 15,000 gal. of water an hour. It is said that in the winter time about 80 per cent of the water going into the boilers has to be made up from the purification plant. Two 5000-hp Vater feed-water heaters, made by the Power Plant Specialty Company, receive exhaust steam from all the station auxiliaries.

The Turbines and the Steam-Heating Arrangement

Four turbines and two engines compose the present prime-mover equipment of the station. The largest of these is a horizontal 5000-kw General Electric turbo-generator set. Of the other turbines, two are Allis-Chalmers machines rated at 1500 kw and 3000 kw. The

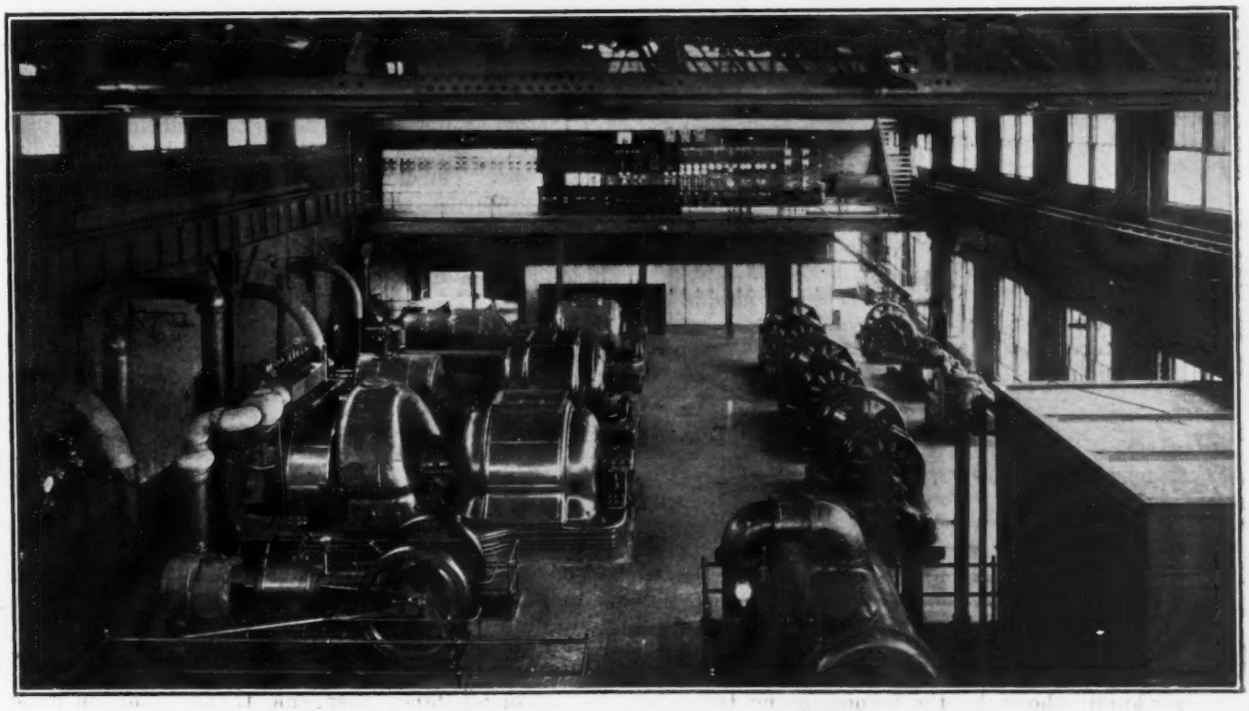


FIG. 1—GENERAL VIEW OF TURBINE ROOM FACING SWITCHBOARD GALLERY

fourth turbo-generator is a 1000-kw General Electric unit of the vertical type. Two Allis-Chalmers cross-compound engines, rated at 600 kw and 800 kw respectively, compose the remainder of the generating equipment. For convenience in connecting these turbo-sets to the system an engineers' panel carrying a speed

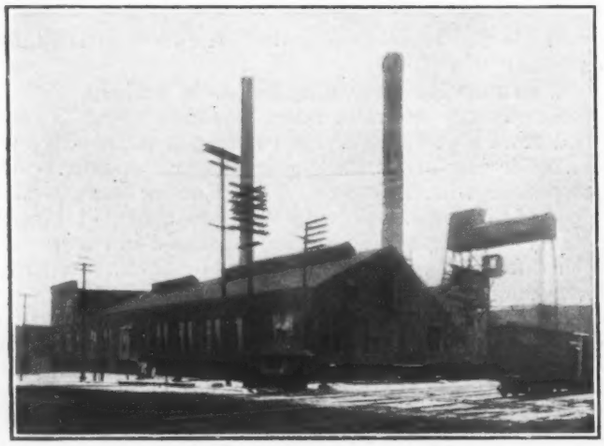


FIG. 2—THE OLD STATION

indicator and an indicating wattmeter has been installed near each generator.

Excitation for the main generators may be supplied from any one of three sources, a 100-kw turbo-generator set, a 100-kw motor-generator set, or a 1120-amp-hr., 500-volt storage battery. At present this battery has but one-half its full quota of plates and, floating on the company's 500-volt system, is rated at 560 amp-hr. To secure emergency 125-volt excitation, taps are taken from only a portion of the cells.

Supplying practically all of the steam for the central-station heating system, the 3000-kw turbine is not provided with a condenser, and for this reason it is seldom operated during hot weather. The other two horizontal turbines, however, exhaust into Wheeler surface-condensers, both of which are of the two-pass type. On account of the improbability of both reciprocating engines being in service at one time, exhaust piping has been arranged so that a common condenser of the Worthington two-pass type serves both. A Worthing-

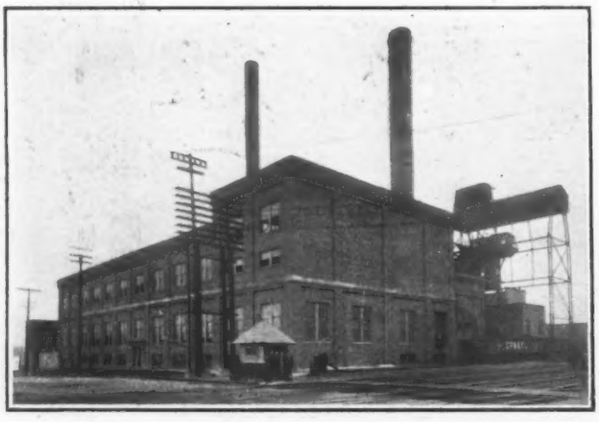


FIG. 3—NEW STATION AND DISTRIBUTION RACK

ton barometric condenser is connected to the vertical turbine so that it may be operated either condensing or non-condensing as conditions dictate. Auxiliaries serving these condensers are of several types, ranging from reciprocating wet-air pumps to the later types of turbine-driven rotative dry-vacuum pumps.

Rearranging the Pump-Pit Equipment

Attempting the simplification of piping in the condenser and pump pits, the company's engineers met a difficult problem. However, by careful measuring and pipe cutting conditions have been changed so that the piping contains far fewer complications than before. With the present layout circulating water for condensers is brought in through a common circulating header to which any or all of the five circulating pumps may be connected. Driven by a 180-hp Kerr turbine, the largest of these pumps is capable of delivering 10,000 gal. of water a minute from its tri-rotor hydraulic element. Another 100-hp turbine-driven pump with a single rotor is rated at 5000 gal. a minute, while the remaining three units are Worthington duplex pumps whose cylinder dimensions are respectively 10 in. by 14 in. by 10 in., 12 in. by 15 in. by 15 in., and 12 in. by 17 in. by 15 in. As the load and temperature of the circulating water varies, the pump whose rating most nearly approaches the circulating-water demand is placed in operation. Arrangements have also been made so that the barometric condenser can be served from an individual pump.

Perhaps the best idea of what has been accomplished in redesigning and reconstructing this generating sta-

FIG. 4—OLD DOUBLE-DECKED SWITCHBOARD

tion is to be had by a comparison of Figs. 4 and 5, showing the old and the new switchboards. Gradual growth of the old station, necessitating the addition of a panel here and there, had resulted in a switchboard built upon two levels. The double deck made operation of the station convenient, but the real difficulties were encountered in changing over the wires from this board to the new switchboard on the operating gallery. As will be seen from the exterior view of the old station, wires for the underground and overhead systems left the building proper by several routes, and in the reconstruction this system was changed so that now all wiring leaves the station through underground ducts. Leads which serve the overhead distribution system are conducted to the top of the terminal rack by means of iron pipe risers. Not only has this enhanced the exterior appearance of the station but it has also given the company a distribution rack upon which an experienced lineman can work with comparative safety. In changing the old wiring a considerable amount of temporary work had to be installed in the corner of the building shown in the foreground of Figs. 2 and 3. Inasmuch as the brickwork of the station was being carried on at the same time and this wiring was on the temporary wall, lintels had to be laid, bridging the temporary work so that the masons could continue their operations above the tem-

porary structure. Later the temporary wiring was torn from the walls and the brickwork completed to fill in the space which had been left vacant.

Divided into three portions, the new switchboard on the operating gallery presents a neat and businesslike appearance. The control of all the main generators and alternating-current feeders is effected from a six-section benchboard. Practically all of the city lighting outside of the main business district is accomplished by series arc lamps, and the energy for this lighting is distributed through a nine-panel blue Vermont switchboard which may be seen with its stab switches in the extreme background of Fig. 5. In the foreground is a thirteen-panel new black-slate switchboard which controls all of the direct-current apparatus in the station, including three 165-kw, 500-volt motor-generator sets supplying direct current for motors in the down-town district of Peoria. These direct-current generators are driven by 2300-volt, three-phase synchronous motors, which operate to raise the general power-factor of the station.

Switches have been installed in the station bus so that it may be divided into four sections. These sections

FIG. 5—SWITCHBOARD GALLERY IN RECONSTRUCTED STATION

are then connected to an auxiliary feeder bus by means of heavy oil switches with rupturing capacities of 25,000 kw each. Oil switches on the feeders are of a lighter type. By this expedient, reducing the number of heavy-duty oil switches to a minimum, considerable money was saved. Oil switches and buses are all inclosed in concrete compartments, this switch-cell structure being situated behind the direct-current switchboard, a part on the operating gallery and a part on the main floor of the station.

In the circuit of single-phase feeders supplying that portion of the city outside of the underground district ten induction regulators have been connected. Situated upon a gallery above the switchboard, these machines have been adjusted so that they will regulate the feeder potential within 10 per cent above and below normal. Thirteen alternating-current feeders supplying the down-town or underground district are supplied from eight transformers in the basement. These feeders leaving the station occupy ducts in the company's clay conduit line. At the station this conduit line contains fifty-four ducts.

Aside from the reconstructed generating station, the system of the Central Illinois Light Company possesses many novel and interesting features. Transmission lines traverse territory rich in coal and agricultural possibilities, and along their routes small generating stations are being replaced with transformer and substations receiving energy from the main steam plant. Two substations of the company, almost identical in their exterior appearance, stand within view of the main generating station, one being upon the same prop-

FIG. 6—WATER-PURIFICATION PLANT AND LIBERTY STREET SUBSTATION

erty and the other just across the Illinois River. The substation in the rear of the generating plant contains three three-phase banks of transformers aggregating 3500 kw and raising the voltage from 2300 to 13,000 for the outgoing transmission line. The high-tension side of the transformers in these substations is protected by electrolyte lightning arresters mounted upon a balcony where all live parts will be above the heads of workmen in the station.

Submarine Cable Crossing

Being served from the main generating station by means of submarine cables, the substation in East Peoria is of particular interest. Traversing the 1500 ft. between the substation and the generating station are two three-phase cables, the conductors of which are

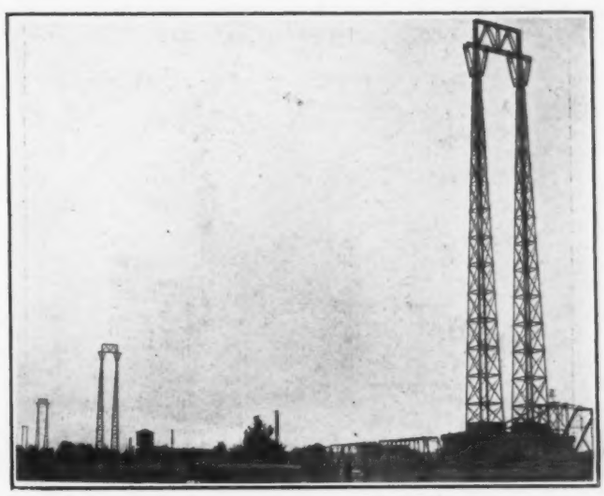


FIG. 7—TRANSMISSION TOWERS ON OLD BRIDGE PIERS AT PEKIN

No. 4 copper. One of these cables is of sufficient rating to carry the entire load, the other being installed as a spare cable to be used only in times of emergency. All operations in the substation, which is without attendant, are controlled from the switchboard in the main gen-

erating station. Circuits for these operations are carried in a seven-conductor control cable traversing practically the same path as the main cables. When these cables were laid all three reels were set upon a barge and the three cables paid out as the boat crossed the stream. Arriving at the opposite bank, the cables were run to the substation in an underground trench. After the cables had been laid a diver spent four days examining them on the river bottom to make sure that none was resting upon sharp projections in the riverbed.

An Economical Power Plant at Pekin

Operating in connection with a steam-heating system, the power plant at Pekin will ultimately be the only other generating station on the company's present system outside of Peoria. One 100-kw and two 200-kw General Electric generators driven by reciprocating engines compose the entire energy-producing equipment of the Pekin station, and in the winter time, when the steam-heating load in the city of Pekin is heavy, these machines are operated at approximately their full rating. If, however, the demand for electricity in Pekin falls short of the output, the excess is delivered over the high-tension line to the company's customers at Peoria. With the steam-heating system in operation, the reciprocating-engine plant at Pekin is capable of producing electrical energy cheaper than it could be put out by the turbines in the main generating station at Peoria. In the summer, however, when there is little or no steam-heating business, this is of course not true, and the

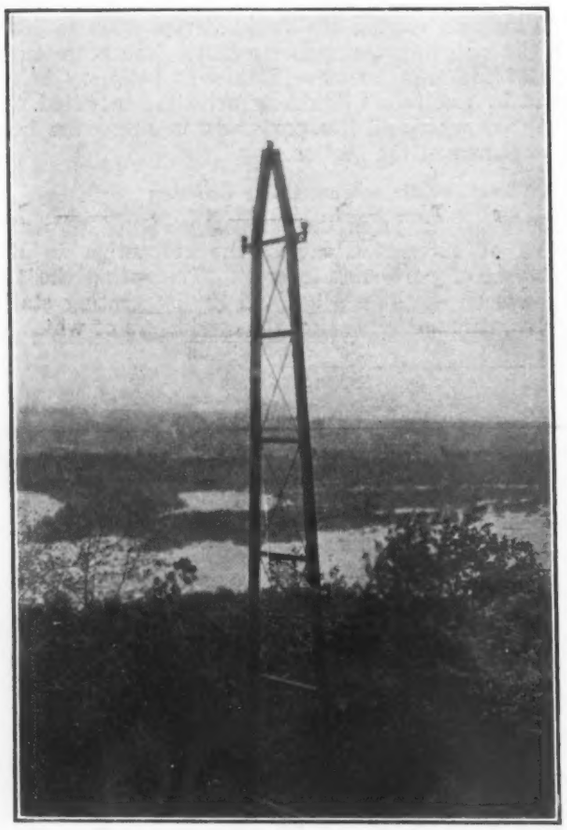


FIG. 8—CHARACTER OF COUNTRY WHERE A-FRAME TOWERS ARE USED

greater part of the electrical energy used in Pekin is supplied over the transmission line from the main generating station.

Between the cities of Peoria and Pekin the major portion of the transmission line, about 7 miles, is carried upon 35-ft. poles, while the remainder, 3 miles, traverses the suburbs of Peoria on a 45-ft. lead. On the latter portion of this line four-pin arms carrying three No. 2 copper wires spaced at 14-in. intervals are mounted upon angle-iron extension pole tops above the city distribution system. Pole spacings of 135 ft. have been used throughout the entire line except at the river crossing at the outskirts of Pekin.

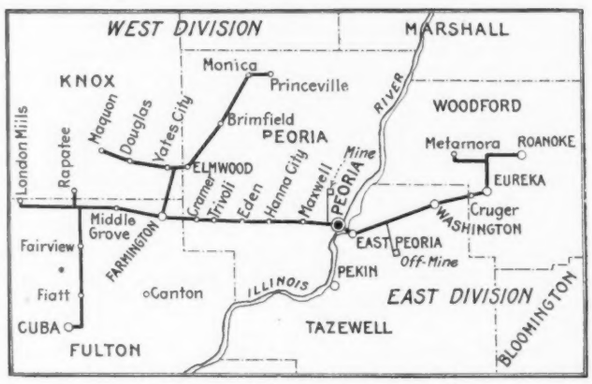


FIG. 9—DIVISION MAP, SHOWING TRANSMISSION SYSTEM OF CENTRAL ILLINOIS COMPANY

Angle-iron towers mounted upon the piers of an old bridge lift the wires at this point 80 ft. above the water, the towers themselves being 100 ft. in height and about 5 ft. square at the base.

Company Tries Experiment in Ground Wires

Transmission lines between Peoria and Eureka are carried on 35-ft. poles spaced 135 ft. on centers. This three-wire circuit of No. 4 copper, although at present operating at 13,000 volts, has been insulated for 33,000 volts. The main-line wires are carried on a 10-ft. by 5.5-in. by 4.5-in. cross-arm, and the 0.375-in. stranded-steel ground wire is supported upon angle-iron bayonets about 4 ft. in length. Where this ground wire is used an earth connection is made at every fifth pole. However, from Eureka to Washington the company is experimenting with a grounded angle-iron bayonet on each pole, dispensing with the continuous ground wire. The extremities of this line extending from Eureka are erected upon 25-ft. poles and operate at 6600 volts. At the junction shown upon the accompanying map the line divides, a single phase being taken to Metamora and another branch of the line going to Roanoke. No. 6 copper wire is used on this line.

Flexible Towers Solve Transmission Problem

Supplying the Off Mine with electrical energy presented one of the most perplexing transmission problems in the building of the company's system. East of Peoria in a densely wooded and almost inaccessible country, seamed with gullies washed out by water rushing rapidly to the Illinois River, the mine entrance could only have been reached on wooden pole lines by traversing a roundabout route approximately 4.5 miles in length. The steep sides and sheer depth of the gullies themselves precluded the possibility of building a wooden-pole line direct to the mine. However, purchasing fifteen 30-ft. flexible A-frame towers and erecting them at the high points in the rough territory, a line was strung to the mine over a route approximately a mile in length. Spans in this line vary from 400 ft. to 800 ft., and where the longer of these spans occur the A-frame towers have been guyed ahead and back with 0.375-in. messenger wire. Trees along the right-of-way have been cleared from beneath the line so that the towers and material could be taken to desired positions. Even after this precaution was taken, however, the task

of transporting the towers to their respective positions proved one of no mean importance, for the character of the country is such that wagon travel is impossible. Hence the towers occupying the most inaccessible points had to be dragged in without the intervention of a wheel conveyance.

West of Peoria, 40-ft. and 45-ft. poles, spaced 140 ft.

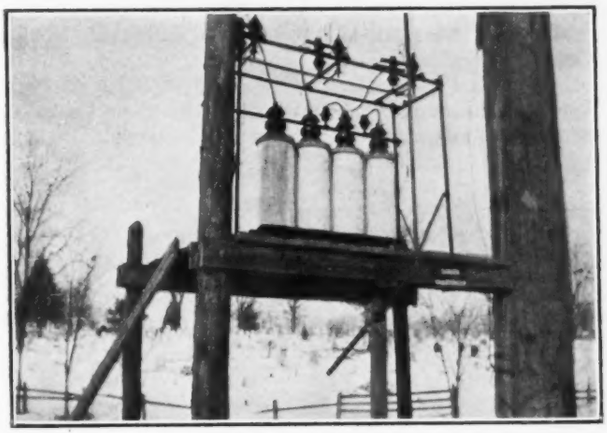


FIG. 10—LIGHTNING ARRESTERS FOR OUTDOOR SUBSTATION

apart, carry the lines to the outskirts of the city, and from there to Farmington 30-ft. poles equipped with standard 10-ft. arms and an angle-iron brace beneath conduct the three-wire No. 2 copper lines to the city of Farmington. Here again the expedient of grounding each bayonet has been adopted. The line is storm-guyed every tenth pole. In connection with storm guys and other strain supports of this character it is planned that in the future no strain insulators shall be used, the guy-wire being a continuous conductor from its upper position to the anchor rods in the ground.

SUBSTATION RATINGS AND POPULATION OF COMMUNITIES

Name	Rating in Kw	Population, 1910
Liberty Street, Peoria	3,500	.....
East Peoria	600	1,493
Off Mine	350	.....
Washington	150	1,530
Eureka	150	1,525
Supplied at 6600 volts from Eureka:		
Cruger	.....	31
Metamora	.....	694
Roanoke	.....	1,311
Pekin	1,000	9,897
Mines east of Peoria	225	.....
Hanna City and mine	300	450
Trivola	10	116
Eden		46
Cramer		84
Farmington	150	2,421
Middle Grove	140	131
Fairview		482
Fiatt		42
Cuba		2,019
London Mills		555
Rapatee		55
Elmwood	100	1,390
Yates City		586
Douglas	35	162
Moquin		472
Brimfield	110	576
Monica		240
Princeville		785
Total	6,820	28,193

From Farmington single-phase lines are extended to Cuba and to London Mills. That part of the company's property embracing Elmwood, Yates City and other cities was not erected by the present management, but was recently purchased and has been connected to the remainder of the system by a short line extending north from Farmington.

Taking over small lighting plants and transmission systems between villages, the company has acquired a considerable number of farm customers. Service lines for these patrons are generally carried upon the same pole line with the high-tension circuits, from one to six farm installations being connected to each transformer. Ordinarily the high-tension side of rural transformers operates at 6600 volts, the secondary lines delivering 220 volts for motor service and 110 volts for lighting. In one case, however, a two-wire, 220-volt secondary had been adopted, both lamps and motors operating at this potential in a very satisfactory manner. The fact that motors are largely operated in the daytime when no lighting is needed was taken into consideration in installing this type of circuit. The average rural customer in central Illinois uses about 230 kw-hr. a year and pays from $27 to $34 for the service.

Organization

The Central Illinois Light Company, being one of the Hodenpyl-Hardy properties controlled by the Union Railway, Gas & Electric Company of New York, is under the management of President B. C. Cobb and Vice-president W. H. Barthold, New York City. Residing at Peoria, Mr. R. S. Wallace is vice-president and general manager, Mr. E. E. Corken is secretary, and Mr. T. A. Schlink is treasurer. Mr. Wallace is widely known and highly esteemed by his electrical confrères in the Middle West. In the electrical department of the company he is assisted by Mr. L. Owen, superintendent of electric department; Mr. G. C. Daniels, superintendent of power plants, and Mr. J. R. Yocum, distribution superintendent in charge of small towns.

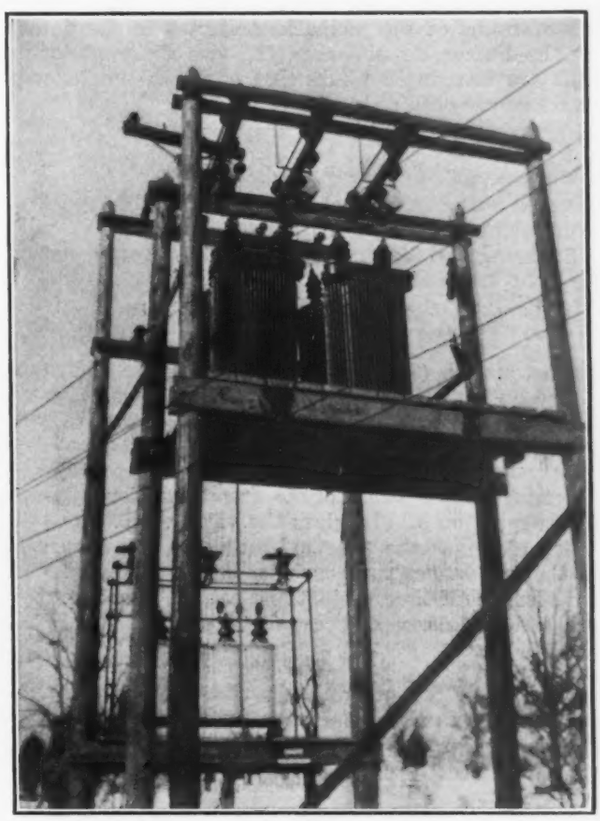


FIG. 11—A TYPICAL OUTDOOR SUBSTATION

The Electrical Constants of Antennas

Accurate Formulas for Determining Inductance and Capacity of Aerials and Frequency of Oscillations in Radiotelegraphy

By Louis Cohen

THE determination of the inductance and capacity of antennas and of the frequency of the oscillations sent out constitutes one of the important measurements in radiotelegraphy. Several methods are available for the measurements of the electrical constants of antennas, but all of them are inaccurate because of the neglect to take into account the distributed character of the inductance and capacity of the antennas. Formulas taking into account the distributed nature of the constants are here given, and it is shown that the error made in assuming that the inductance and capacity are lumped may be considerable, amounting to as much as 20 per cent in some cases.

For the purpose of comparison the theory of one of the methods generally employed is first given, which is as follows: Two loading inductance coils are separately introduced in the antenna circuit, oscillations are excited by a buzzer circuit, and the corresponding wave lengths are measured by a wave meter. If it be assumed that the total inductance and capacity of the antenna may be considered as lumped and if their values be denoted by L_1 and C_1, and the inductance of the loading coils be denoted by L_0 and L_0', and the corresponding wave-lengths of the oscillations excited in the antenna by the buzzer circuit when the two different loading coils are introduced be denoted by λ_1, λ_2, the following relations are obtained:

$$\left.\begin{aligned}\lambda_1 &= 2\pi u \sqrt{(L_0 + L_1) C_1}\\ \lambda_2 &= 2\pi u \sqrt{(L_0' + L_1) C_1}\end{aligned}\right\} \quad (1)$$

where u is the velocity of light in air, and L and C are expressed in henries and farads.

Squaring and taking the ratio of the above equations, we have

$$\frac{\lambda_1^2}{\lambda_2^2} = \frac{L_0 + L_1}{L_0' + L_1} \quad (2)$$

From equation (2) can be evaluated L_1, the inductance of the antenna, in terms of the known quantities, viz.,

$$L_1 = \frac{L_0 \lambda_2^2 - L_0 \lambda_1^2}{\lambda_1^2 - \lambda_2^2}. \quad (3)$$

Substituting the value of L_1 from equation (3) into either equation of (1) gives the value of C_1.

Consider now the effect of the distributed character of the inductance and capacity of an antenna. The wave-length of free oscillations set up in a circuit of localized inductance and capacity L_1 C_1 is

$$\lambda = 2\pi u \sqrt{L_1 C_1} \quad (4)$$

In the case of uniformly distributed inductance and capacity, the fundamental wave-length of oscillation set up in a line, grounded at one end and open at the other end, is*

$$\lambda = 4u\sqrt{L_1 C_1} \quad (5)$$

where L_1 and C_1 are the total inductance and capacity of the line.

In the case of a loaded antenna (Fig. 1) a lumped inductance is in series with a distributed inductance and capacity, and the wave-length of oscillations set up in a circuit of such a character has a value which is between the extremes given by equations (4) and (5), depending on the ratio of the loading inductance to the distributed inductance.

Let L and C be the inductance and capacity per unit length of antenna, then, neglecting the resistance, the following fundamental equations are obtained:

$$\left.\begin{aligned}L\frac{dI}{dt} &= -\frac{dv}{ds}\\ C\frac{dv}{dt} &= -\frac{dI}{ds}\end{aligned}\right\} \quad (6)$$

By differentiation and substitution of each of these equations in the other, the following are obtained:

$$\left.\begin{aligned}LC\frac{d^2i}{dt^2} &= \frac{d^2i}{ds^2}\\ LC\frac{d^2v}{dt^2} &= \frac{d^2v}{ds^2}\end{aligned}\right\} \quad (7)$$

The solutions of equations (7) are well known. One has

$$\left.\begin{aligned}I &= \sum_{n=1}^{n=\infty} \begin{matrix}(A_{1\,n}\cos\beta_n t + A_{2\,n}\sin\beta_n t)\\ (B_{1\,n}\cos K_n s + B_{2\,n}\sin K_n s)\end{matrix}\\ v &= \sqrt{\frac{L}{C}}\sum_{n=1}^{n=\infty} \begin{matrix}(A_{1\,n}\sin\beta_n t - A_{2\,n}\cos\beta_n t)\\ (B_{1\,n}\sin K_n s - B_{2\,n}\cos K_n s)\end{matrix}\end{aligned}\right\} \quad (8)$$

where

$$\beta_n = \frac{K_n}{\sqrt{LC}} \quad (9)$$

The current and potential on the line are complex waves consisting of a fundamental wave and harmonics. Considering only the fundamental, one obtains:

$$\left.\begin{aligned}I &= \begin{matrix}(A_1\cos\beta t + A_2\sin\beta t)\\ (B_1\cos KS + B_2\sin KS)\end{matrix}\\ v &= \sqrt{\frac{L}{C}}\begin{matrix}(A_1\sin\beta t - A_2\cos\beta t)\\ (B_1\sin KS - B_2\cos KS)\end{matrix}\end{aligned}\right\} \quad (10)$$

and

$$\beta = \frac{K}{\sqrt{LC}}$$

The frequency of the oscillations, corresponding to the fundamental wave-length, is given by

$$f = \frac{\beta}{2\pi} = \frac{K}{2\pi\sqrt{LC}} = \frac{Kl}{2\pi\sqrt{L_1 C_1}} \quad (11)$$

where l is the length of the antenna, $L_1 = Ll$ total inductance of antenna, $C_1 = Cl$ total capacity of the antenna. The fundamental wave-length is

$$\lambda = \frac{2\pi\sqrt{L_1 C_1}}{Kl} \quad (12)$$

The frequency or the wave-length is a function of the inductance and capacity and the constant K which is to be determined from the boundary conditions of the problem.

When the antenna is grounded at one end, say at $S = l$, through a coil having an inductance L_0 and negligible resistance, and is open at the other end, say at $S = 0$, the terminal conditions are the following:

$$\left.\begin{aligned}&\text{at } S = l,\ I = 0\\ &\text{at } S = 0,\ v + L_0\frac{dI}{dt} = 0\end{aligned}\right\} \quad (13)$$

Substituting the values from (13) into (10), there is obtained:

*See "Formulae and Tables for the Calculation of Alternating-Current Problems," by Louis Cohen, page 238.

$$\left.\begin{aligned} B_1 \cos Kl + B_2 \sin Kl &= 0 \\ B_2\sqrt{\frac{L}{C}} + B_1\beta L_0 &= 0 \end{aligned}\right\} \qquad (14)$$

Eliminating $\frac{B_2}{B_1}$ from equations (14), there is obtained the following:

$$\cot Kl = \beta L_0 \sqrt{\frac{C}{L}} = \frac{KL_0}{L} = Kl\frac{L_0}{L_1} \qquad (15)$$

The above is a transcendental equation from which to determine Kl, which can be done only graphically. One may put

$$\left.\begin{aligned} y_1 &= \cot Kl \\ y_2 &= \frac{L_0}{L_1}\, Kl \end{aligned}\right\} \qquad (16)$$

and plot curves with Kl as abscissa, and y_1, y_2 as ordinates. The points of intersection of the two systems of curves give the values of Kl which satisfy equation (15), and hence the conditions of the problem. In Fig. 2 curves y_1 and y_2 are plotted for different values of $\frac{L_0}{L_1}$. The points of intersection on the first curve y_1 give the values of Kl corresponding to the fundamental frequency of the oscillations, and the points of intersections on succeeding curves give the values of Kl for the different harmonics.

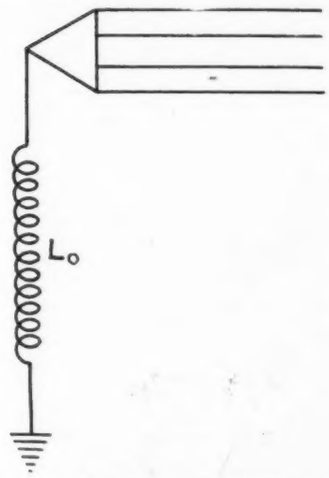


FIG. 1—CIRCUITS OF LOADED ANTENNA

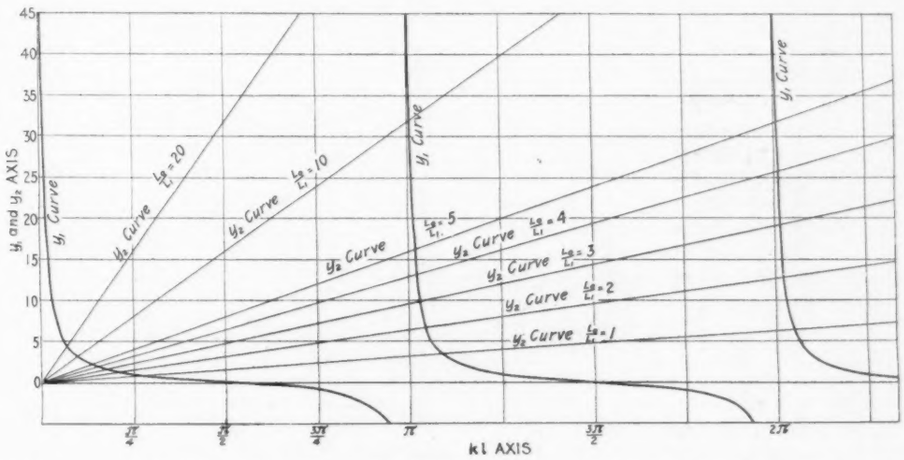


FIG. 2—GRAPHICAL REPRESENTATION OF ANTENNA CONSTANTS

Calculation of the Frequency of a Loaded Antenna

The calculation of the frequency of a loaded antenna is readily effected by the use of the curves given in Fig. 2. The procedure is best shown by a numerical example. Let the inductance of the loading coil have the same value as the inductance of the antenna, then $\frac{L_0}{L_1} = 1$, and the curve y_2 corresponding to this value intersects the first curve y_1 at the point $Kl = 0.82$. Using this value of Kl in equation (11), there is obtained for the fundamental frequency:

$$f = \frac{0.82}{2\pi\sqrt{L_1 C_1}}.$$

Assume the following values for the inductance and capacity of the antenna,

$$L_1 = 0.05 \text{ mh},$$
$$C_1 = 0.001 \text{ mf},$$

then

$$f = \frac{0.82}{2\pi\sqrt{5 \times 10^{-5} \times 10^{-9}}} = 585{,}700.$$

Considering the inductance and capacity of the antenna as localized, the fundamental frequency becomes

$$f = \frac{1}{2\pi\sqrt{(L_0 + L_1)\, C_1}} = \frac{1}{2\pi\sqrt{10^{-4} \times 10^{-9}}} = 503{,}200,$$

a difference in the two cases of about 16 per cent. One may also look at the problem from a different angle. Suppose there be set up electrical oscillations in the antenna circuit, let the frequency be measured by a frequency meter. There would be obtained the correct frequency, which is in this case 585,700. If the inductances of the antenna and loading coil be known, in this case each 0.05 mh, and the capacity be determined by the formula $f = \frac{1}{2\pi\sqrt{LC}}$, then there is obtained for the value of the antenna capacity, $C = 0.00073$ mf, while the actual capacity of the antenna is 0.001 mf, an error of 27 per cent. The neglect in this case to take into account the distributed character of the inductance and capacity leads to a considerable error in the determination of the antenna capacity.

Referring in Fig. 2 to the point of intersection of the curve $y_2\left(\frac{L_0}{L_1} = 1\right)$ with the second curve y_1, it is found that $Kl = 3.44$, which introduced in formula (11) gives a value for the frequency four and two-tenths times the fundamental frequency. By extending the straight-line curve y_2 and noting the values of Kl for the succeeding intersecting points with the curves y_1, one can determine the values of the frequencies of the different harmonics. It is to be noted that they are not whole multiples of the fundamental.

For the value $\frac{L_0}{L_1} = 3$, there are obtained from Fig. 2 for the first intersecting point, which corresponds to the fundamental frequency, $Kl = 0.54$ and

$$f = \frac{0.54}{2\pi\sqrt{5 \times 10^{-5} \times 10^{-9}}} = 385{,}700.$$

On the assumption of localized inductance and capacity, one would have

$$f = \frac{1}{2\pi\sqrt{2 \times 10^{-4} \times 10^{-9}}} = 356{,}700,$$

a difference in the two cases of about 8 per cent.

Measuring the frequency by a wave meter and determining the capacity by the formula $f = \frac{1}{2\pi\sqrt{(L_0 + L_1)\, C_1}}$, one gets for the value of the an-

tenna capacity $C = 0.00084$ mf. The actual capacity is 0.001 mf, and the error in this case would be 16 per cent.

It is to be observed that, on the assumption that the antenna inductance and capacity may be considered as localized, the value of the capacity at frequencies 585,700 and 385,700 would be 0.00073 mf and 0.00084 mf, respectively, which would indicate a variation of capacity with the frequency. This, however, is only apparently so, and, as was pointed out, arises from the fact that the distributed character of the capacity is not taken into account.

In using larger values of $\frac{L_0}{L_1}$ the apparent capacity obtained by measuring the frequency and using the formula $f = \frac{1}{2\pi\sqrt{(L_0 + L_1)\,C_1}}$ approximates more closely the actual capacity. It may be concluded, therefore, that in measuring antenna constants the assumption of localized inductance and capacity is permissible only when the inductance of the loading coil is comparatively large, about twenty times or more the inductance of the antenna. When high frequencies are used in the measurements, with small loading inductance coil, formula (11) and the curves given here must be made use of.

As a check on the results obtained by the use of the curves, consider the extreme case $\frac{L_0}{L_1} = 0$; that is, no loading coil, a simple antenna. In this case the curve y_2 coincides with the abscissa axis, and the point of intersection with the first curve y_1 is at $Kl = \frac{\pi}{2}$.

Then

$$f = \frac{\pi/2}{2\pi\sqrt{L_1C_1}} = \frac{1}{4\sqrt{L_1C_1}} \qquad (17)$$

and $$\lambda = 4\sqrt{L_1C_1},$$

which is formula (5), as is to be expected, since in this case the antenna is simply a line grounded at one end and open at the other end.

ELECTRIC TOWING SYSTEM FOR PANAMA

Difficulties Encountered in Getting Ships Safely Through the Canal Locks Met by Specially Designed Locomotives

AFTER a very thorough study of the entire problem of maneuvering ships through the locks of the Panama Canal, it became evident that ships should not proceed through the locks under their own power because of the danger of collisions with the locks. A substitute for the ship's power should embrace the following requirements: It should place the ship in proper relation to the lock. It should keep the ship to its course. It should accelerate and retard the ship without rupturing the lines. The lines when once attached should be used without change for lockage in flight. It should require a small number of skilled operatives rather than a large number of unskilled men. The towing system which was adopted is described in the following pages. It was designed and patented by Mr. Edward Schildhauer, electrical and mechanical engineer of the Isthmian Canal Commission. The forty towing locomotives and all the electrical apparatus for operating the locks were built by the General Electric Company.

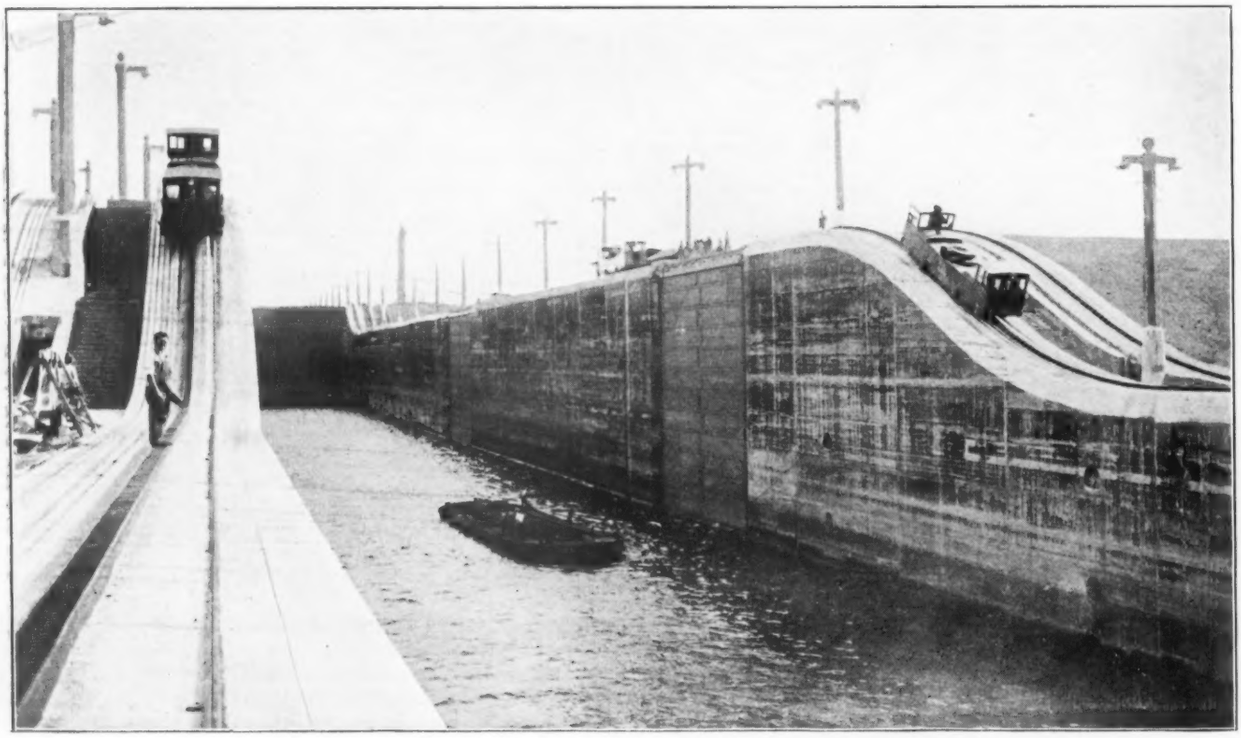


FIG. 1—FIRST TRIAL TOW APPROACHING SECOND LEVEL, GATUN LOCKS

Towing System

The main features of all the lock sites are identical. Two ship channels, one for traffic in each direction, are provided at each lock. The channels are separated by a center wall, the total length of which is 6330 ft. Each of the outer walls has two systems of tracks, one for the locomotive when towing and the other for the locomotive when returning idle. For the center wall there is one return track in common for both the towing tracks. The towing tracks are naturally placed next to the channel side. Four locomotives running along the lock walls are normally employed. Two of the locomotives are opposite each other in advance of the vessel, and two run opposite each other to the rear of the vessel, as seen in Fig. 2. The number of locomotives is, however, increased when the tonnage of the ship demands it. Cables connect the locomotives to the vessel as shown.

The lengths of the various cables are adjusted by a special winding drum on the locomotive so as to place the vessel substantially in mid-channel. When the leading locomotives are started they will tow the vessel. The trailing locomotives will follow and keep all the cables taut. By changing the lengths of the rear cables the vessel can be guided. To stop the vessel all the locomotives are slowed down and stopped, thus bringing the rear locomotives in action to retard the ship. The illustration in Fig. 1 shows how effectively the four locomotives keep the vessel under control and in the center of the channel, while Fig. 3 shows a trial tow approaching the second level. The water in the middle lock or the second level is at sea level, a condition not obtained in regular operation.

Rack Rails

The towing tracks have a specially designed rack rail extending the entire length of the track and erected centrally between the running rails. It is through this rack rail that the locomotive exerts the traction necessary for propelling large ships and climbing the steep inclines. Rack rails are also provided on short portions of the return track so as to lower the locomotives safely from one level to the next, the steepest slope being 26 deg., or 44 per cent.

Another feature of the rack rail is the projecting edges, which permit thrust wheels attached to the locomotive to run along the under side and prevent overturning of the locomotive in case some unforeseen operating condition should produce an excessive pull on the towline. These thrust wheels serve to counteract the lateral component of the tow-line pull, and the flanges serve only as an emergency feature, as the weight of the locomotive is sufficient to prevent overturning with a normal pull of 25,000 lb. on the towline.

A three-phase, twenty-five-cycle, 220-volt alternating-current system is used for supplying the locomotives with energy through an underground contact system. The collecting device is adjacent to the running rail on the side remote from the lock. Two T-rails form two legs of the three-phase circuit, and the third leg is formed by the main track rails. A specially designed contact plow slides between the two T-conductors and transmits the power from the rails to the locomotive.

Locomotive Design

The working parts of the locomotive are supported by two longitudinal upright side frames of cast steel connected by transverse beams. Each of the two axles of a locomotive is driven by its own motor, independent of the other. Each of the two motors is of the three-phase, slip-ring type, inclosed, and identical with the rugged steel-mill design. Each is geared by a pinion and spur gear to a countershaft, which carries a pinion meshing with a spur gear keyed to a jack shaft. On the outer side of the spur gear keyed to the jack shaft are formed clutch teeth which co-operate with similar teeth on the adjacent side of a gear which is sleeved upon the jack shaft and can be moved lengthwise thereon to engage and disengage the clutch teeth. The sliding gear is capable of meshing with a pinion on the axle when in contact with the clutch teeth on the spur gear. When the gears are in the position named the motor will propel the locomotive by means of the adhesion between the wheels on that axle and the rails of the track. This only occurs when running without load and between inclines.

When the locomotive, however, reaches one of the inclines between the locks, the grade of which may be as great as 44 per cent, or when it is towing a ship, the cog-rail system is utilized to enable the locomotive to climb the grade and exert the traction necessary for pulling large ships. The cog or rack rail is laid between the track rails, and the locomotive is provided with a cog wheel or rack pinion, which is secured to a sleeve rotating freely on the axle.

An elastic arm serves to throw the clutches for the gearing automatically. In most cases the four-jaw clutches employed do not mesh when thrown, but the operating handle is thrown full stroke and locked. This puts a set of springs under heavy tension. The locomotive is then started slowly, and when the clutches are in alignment the springs automatically cause the gears to mesh.

The two traction motors are controlled by suitable controllers installed in the cabs at the ends of the locomotives. The circuits are such that both motors can be controlled from either cab and can be operated singly or in multiple as desired. Energy is taken from the supply conductors by means of a special shoe.

Brakes

Each motor is provided with a powerful brake. Since the motors are at all times geared either to the axles or to the cog wheels, the truck wheels are not provided with any brake rigging. On the motor shaft is keyed a brake disk or drum, and to opposite sides thereof are applied the brake shoes which are carried by the brake levers. These levers are pivoted in such a way that the solenoid controlling them will release the brake when energized. The first point of the controller raises the brakes without applying power to the motors, thereby

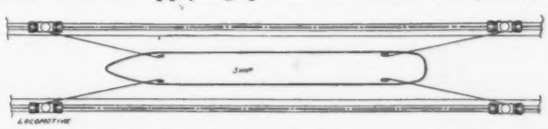


FIG. 2—ARRANGEMENT OF TOWING CABLES AND LOCOMOTIVES

providing a coasting point. But should the motor current be shut off, either intentionally or accidentally, the core will instantly drop by gravity and apply the brakes. This action occurs simultaneously on both motors, and the braking force is powerful enough to stop the locomotive within two revolutions of the wheels.

In addition to this automatic brake, means are provided for applying the brakes manually in order to supplement the action of the automatic feature, if necessary, when descending a grade or where approaching a rack rail. These brakes are of the chain type and utilize the levers and shoes of the automatic brake. Both brakes may be applied at once if necessary to effect a very sudden stop.

The drum on which the cable is wound is placed midway between the ends of the locomotive. The cable can hence be led off on either side of the machine and through a wide range of angles to the line of travel. A motor with a bevel-gear pinion is used for driving the drum at a high speed when coiling the cable that has been cast off, and it remains permanently in gear. Another motor with worm-gear drive is used for taking in the cable when it is under load.

Owing to the greater gear reduction, the worm-geared motor rotates the drum at a much slower speed than the bevel-geared motor. Consequently, with motors of approximately equal size, a greater force may be exerted on the tow line than would be possible with the lower speed reduction which is used with the high-speed coiling motor. The worm-gear drive is connected with the drum when in use by means of a solenoid-operated clutch.

The guide which directs the cable, as it pays out or winds up, is mounted so as to revolve on the axis of the drum. It comprises two angularly adjustable por-

tions, the former being a circular bell which serves as a cover for the winding drum. At one side the shell is cut away to admit the cable to the drum. On either side of the opening are two upright guide rolls having cylindrical faces. Rollers are also provided to assist in the rotation of the guide. The other guide member is a radial casting, having one end turning freely on the hub of the drum. The outer end of this guide member is an upright rectangular frame, at the top and bottom of which is journaled a swivel carrying two grooved sheaves. The edges of these sheaves are in close contact, so that their grooves form an opening through which the cable passes, approximately, in line with the middle of the guide rollers. The rectangular frame is supported by rollers running in a circular track. When the cable is pulled either forward or backward from its middle position the swivel permits the grooved sheaves to move with it, and the guide member swings also, so that the sheaves continue to support the rope in a line with the middle of the guide rollers without being themselves subjected to any side strain. All lateral strains are sustained by heavy guide rollers, the cable moving up and down between them as it winds on the drum. The latter is in the form of a deeply grooved wheel, the groove being U-shaped.

The cable guard is a steel casting having a thickness

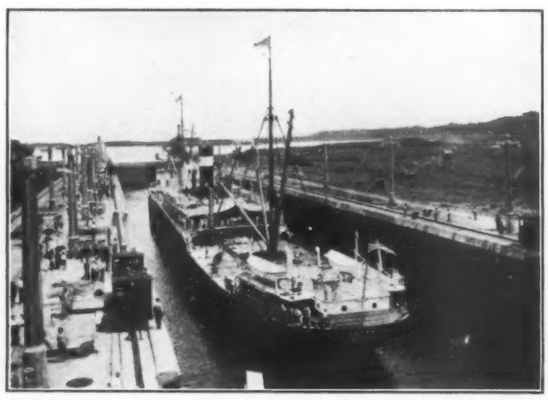


FIG. 3—SHIP ENTERING LOCK UNDER TOW OF ELECTRIC LOCOMOTIVE

of only $\frac{3}{8}$ in. The diameter is 4.5 ft. and the circular flange is 17 in. deep. The castings were produced in the contractor's electric furnace. No failures occurred. With the exception noted, all other principal steel castings for these locomotives were produced at the plant of the Wheeling Mold & Foundry Company, Wheeling, W. Va.

One of the most important parts of the locomotive is the "slip-friction" device, consisting of two special alloy rings mounted on the spider. Between these rings a steel disk is fastened to the rope drum. The amount of tension on the tow line is adjusted by the pressure between these three disks and is obtained by tightening the spiral springs on a clamping ring. In order, therefore, to make the slipping tension of the tow line proportional to the pressure between the friction disks, a rubbing surface having an absolutely constant coefficient of friction is essential. A low-friction metal having an almost constant coefficient of friction of 0.1 was selected for the work. This metal showed but very little difference in its coefficient of friction at starting and in motion. The results of the special tests were furthermore amply verified by the final test of the friction disks of each machine under a full-rated tow-line pull of 25,000 lb. All machines passed the government requirement not to exceed a variation of 5 per cent above or below the normal of 25,000 lb.

The rapid-coiling motor is permanently geared to the drum and is of the same type, size and capacity as the winding motor. It is subjected to its maximum load when accelerating the heavy drum to the high speed required for coiling or paying out the rope, this being sixteen times the slow-winding speed at full load, or about 200 ft. per minute.

The slow-winding and the rapid-coiling motors are operated by similar controllers, and the circuits are electrically interlocked so as to prohibit application of power to either motor unless the controller of the other motor is in the "off" position.

Each of the two main traction motors has a rating of 75 hp and is of the slip-ring induction type, operated by a system of contactors with a master controller in each cab. The motors, by means of the change in gearing from straight traction to rack-rail towing previously described, drive the locomotive at a speed of 2 miles per hour when towing and 5 miles per hour when returning idle. These motors act as induction generators running above synchronous speed when the locomotive is passing down the steep inclines and thereby exert a braking effect to keep the speed uniform.

The locomotives have a net weight of 86,300 lb. and a gross shipping weight of 92,500 lb. They were mounted on specially designed skids and shipped by rail to New York, where they were loaded on board the ships as deck cargoes by means of a Merritt-Chapman 125-ton floating derrick.

During the first three months of commercial operation of the canal, from Aug. 15 to Nov. 15, the cargo transported through the canal and towed through the locks by the locomotives amounted to 1,079,521 tons. During the fiscal year ended June 30, 1914, the Panama Railroad carried 643,178 tons of through freight between the two seaboards, and in the preceding fiscal year 594,040 tons. From this it is seen that between six and seven times as much cargo is passing over the Isthmus now as passed over this route when goods were transshipped by rail.

Central-Station Heating in Winter Conditions

According to Mr. A. C. Rogers, who is in charge of the central-station heating department of the Toledo (Ohio) Railways & Light Company, only four or five times in the last forty years has the month of December produced more severe weather conditions than those of 1914. The sudden changes in temperature, ranging from 45 deg. Fahr. above zero to several degrees below zero, made it particularly difficult to render uniformly satisfactory heating service, because, following a sudden drop in temperature, the average person desires greater warmth in his house or office than he would if the same outdoor temperature had been arrived at gradually or had been continuous over a period of several days.

Exactly the opposite condition prevails when the mercury in the thermometer jumps from zero to 40 deg. Fahr. in a few hours. A man under these conditions is apt to consider an office temperature of 70 deg. Fahr. too hot, while under ordinary circumstances the same man would be comfortable in a room where the thermometer registered 75 deg. Fahr.

Having observed these conditions frequently, Mr. Rogers has suggested that central-station heating companies might obtain credit for maintaining better service if during times of rapidly falling temperature they temporarily increased the normal temperature of the outgoing heating medium by, say, 5 deg. or 10 deg. Fahr. Then, when the mercury column was rising they could reduce the temperature of the station output by the same amount.

CENSUS OF GENERATING EQUIPMENT

Large Increase in Number and Rating of Alternating and Polyphase Current Dynamos in Central Stations

The Bureau of the Census returns on generating equipment and output of stations in 1912 show dynamos of three classes—direct-current constant-voltage, direct-current constant-amperage, and alternating and polyphase current. The total number of dynamos of all classes in 1912 was 15,393 with a rating of 7,642,755 kw. The total number was almost the same in the other two census periods, being 15,297 in 1907 and 15,786 in 1902; the total rating for 1912, however, is an increase of 72.4 per cent over the rating of 4,432,641 kw for 1907 and of 262.1 per cent over the 2,110,597 kw for 1902.

The most significant change in the figures is the increase in alternating and polyphase current dynamos from a total number of 5563 and a rating of 909,320 kw in 1902 to 7740 with 3,003,687 kw rating in 1907 and 9606 with 6,399,390 kw rating in 1912. These figures represent an increase of 39.1 per cent in number and 230.3 per cent in kilowatt rating from 1902 to 1907 and of 24.1 per cent in number and 113.1 per cent in kilowatt rating from 1907 to 1912. The total increase in rating from 1902 to 1912 is 603.8 per cent.

In the ten years the direct-current constant-voltage dynamos decreased from 6684 in number in 1902 to 4967 in 1912, although the rating increased slightly, from 1,055,411 kw in 1902 to 1,161,213 kw in 1912. Direct-current constant-amperage dynamos decreased from 3539 in 1902 to 820 in 1912, while the rating decreased in that period from 145,866 in 1902 to 82,152 in 1912, or 43.7 per cent. Although the decrease in the number of dynamos in central electric stations and electric-railway stations combined from 1902 to 1912 was 2.5 per cent, the total rating increased in that period 262.1 per cent. Of the increase in rating 70.9 per cent was contributed by central stations. Of the total kilowatt rating alternating-current machines showed 83.7 per cent in 1912 and 43.1 per cent in 1902, while the direct-current dynamos represented 16.3 per cent and 56.9 per cent respectively at the two periods named. Table I shows the different classes.

Direct-current constant-voltage dynamos in central stations increased between 1907 and 1912 in rating 23,202 kw, or 5.7 per cent; in electric railways there was a decrease in the same period of 209,951 kw, or 22.3 per cent. Constant-voltage dynamos formed 15.2 per cent of the rating of all classes for central stations and electric railways combined in 1912, as compared with 30.4 per cent in 1907 and 50 per cent in 1902. The percentages for central stations alone for the years named were respectively 8.4, 15 and 27.2 and for electric-railway plants 29.2, 54.6 and 80.7. The increase in the use of alternating-current dynamos is shown by the fact that they represented in 1912 for all stations combined 83.7 per cent of the total kilowatt rating, as compared with 67.8 per cent in 1907 and 43.1 per cent in 1902. For central stations the percentages were 90.8 in 1912, 82 in 1907 and 60.7 in 1902, as compared with 69.3, 45.4 and 19.3 respectively for electric railways. The average number of dynamos for all central stations is a little more than 2. The number of stations using direct-current constant-amperage dynamos decreased from 1902 to 1912 941, or 81.1 per cent. These figures were made up of a reduction of 716, or 82.9 per cent, in commercial stations using this type of dynamos and of 225, or 76 per cent, in municipal stations. The number of stations having alternating-current dynamos increased 1095, or 41.6 per cent, from 1902 to 1912. Commercial stations contributed 493, or 45 per cent, and municipal stations 602, or 55 per cent, toward this decrease.

The total average kilowatt rating per station for all classes of dynamos combined increased between 1902 and 1912 from 335 kw to 983 kw, equal to 648 kw, or 193.4 per cent. The average rating for commercial stations increased in this period 910 kw as compared with 97 kw for municipal stations. The average rating of alternating and polyphase current dynamos per combined commercial and municipal station was 1250 kw in 1912 as compared with 645 kw in 1907 and 280 kw in 1902. The average per machine was 552 kw in 1912 as compared with 326 kw in 1907 and 144 kw in 1902. While the average rating of alternating and polyphase current dynamos per commercial and municipal station combined increased 346.4 per cent from 1902 to 1912, the average rating per machine increased 283.3 per cent.

The total kilowatt rating of dynamos installed in central electric stations increased 3,922,454 kw, or 323.6 per cent, from 1902 to 1912. Of this increase 3,667,157 kw, or 93.5 per cent, came from commercial stations and 255,297 kw, or 6.5 per cent, from municipal stations.

Of the total kilowatt rating reported for 1912, the Middle Atlantic, East North Central, Pacific and New England groups of states contributed 73 per cent. The South Atlantic division reported an increase of 31.3 per cent in the number of stations and 111.3 per cent in kilowatt rating. The Pacific group of states reported a decrease of 5 per cent in the number of stations and an increase in kilowatt rating of 101 per cent. From 1907 to 1912, when the number of stations in the United States as a whole increased 10.8 per cent, the kilowatt rating of dynamos increased 89.5 per cent. Of the total number of stations in 1912, municipal and commercial combined, with a rating of 5,134,689 kw in dynamos, 161 stations having dynamo ratings of 5000 kw and over showed an aggregate rating of 3,610,240 kw, or 70.3 per cent of the total. The Middle Atlantic group of states had 32 of the stations having a dynamo capacity of 5000 kw and over, with an aggregate of 1,095,267 kw.

The totals of the kilowatt rating of dynamos of central electric stations by states in 1902 and 1912 show great differences in development. New York, with a total rating of 772,030 kw in dynamos, is first, and is followed by California with 588,281 kw, Illinois with 449,917 kw and Pennsylvania with 427,304 kw. The smallest states in kilowatt rating of dynamos are New Mexico, Wyom-

TABLE I—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—NUMBER, KIND AND KW RATING OF DYNAMOS—1912, 1907 AND 1902

	Total		Kind of Dynamos					
			Direct-Current Constant-Voltage		Direct-Current Constant-Amperage		Alternating and Polyphase Current	
	Number	Kilowatt Rating	Number	Kilowatt Rating	Number	Kilowatt Rating	Number	Kilowatt Rating
Total 1912	15,393	7,642,755	4,967	1,161,213	820	82,152	9,606	6,399,390
1907	15,297	4,432,641	5,872	1,347,962	1,685	80,992	7,740	3,003,687
1902	15,786	2,110,597	6,684	1,055,411	3,539	145,866	5,563	909,320
Commercial 1912	9,837	4,766,012	2,821	398,046	518	30,880	6,498	4,337,086
1907	9,778	2,500,209	3,169	379,706	1,246	61,753	5,363	2,058,750
1902	10,662	1,098,855	3,405	312,509	2,957	117,695	4,300	668,651
Municipal 1912	2,760	368,677	580	31,316	227	12,948	1,953	324,113
1907	2,395	209,016	511	26,754	439	19,239	1,445	163,023
1902	1,822	113,380	418	17,556	582	28,171	822	67,653
Electric railways 1912	2,796	2,508,066	1,566	731,551	75	38,324	1,155	1,738,191
1907	3,124	1,723,416	2,192	941,502	*	*	932	781,914
1902	3,302	898,362	2,861	725,346	*	*	441	173,016
Per cent of increase:†								
Total 1902 to 1912	−2.5	262.1	−25.7	10.0	−76.8	−43.7	72.7	603.8
1907 to 1912	‡	72.4	−15.4	−13.9	−51.3	1.4	24.1	113.1
1902 to 1907	−3.1	110.0	−12.1	27.7	−52.4	−44.5	39.1	230.3

*Not reported separately. †A minus sign (−) denotes decrease. ‡Less than one-tenth of 1 per cent.

ing and North Dakota, with respectively 7981 kw, 8212 kw and 10,824 kw. The largest increase in rating of dynamos in any state from 1902 to 1912 was in New York, 584,778 kw. California was not far behind, with an increase of 504,465 kw. The percentage of increase in New York in ten years was 312.3, while in California it was 601.9. Illinois increased 349,597 kw, or 348.5 per cent. The smallest states in increase were Wyoming with 6381 kw increase in ten years, New Mexico with 6995 kw increase, and North Dakota with 8782 kw increase. The largest states in percentage of gain in ten years were Nevada with 1276 per cent, Idaho with 1185.4 per cent, and Oklahoma with 1168.7 per cent. The smallest percentage gain was by North Carolina, which showed 4.1 per cent. Virginia showed 5.9 per cent.

In 1912 507 central electric stations, or 9.7 per cent of the total number, had no generating equipment, as compared with 22.7, or 4.8 per cent, in 1907, or an increase of 123.3 per cent. In 1902 2.2 per cent of the central electric stations were without generating equipment. This indicates the greater dependence on larger generating stations and the transmission of energy and also shows further concentration of control.

In 1912 the total amount of electrical energy generated was 17,585,662,014 kw-hr. This is an increase of 65.6 per cent from 1907 and 268.8 per cent from 1902. The increase from 1902 to 1907 was greater than during the last census period of five years, being 122.7 per cent. Of the total output central commercial stations furnished 62.5 per cent in 1912, 52.5 per cent in 1907, and 48.5 per cent in 1902. Municipal plants furnished 3.1 per cent in 1912, 2.7 per cent in 1907, and 4.1 per cent in 1902. Electric railways had 34.4 per cent in 1912, 44.8 per cent in 1907, and 47.4 per cent in 1902. The output of the municipal stations, which composed 7.8 per cent of the total for central stations in 1912 and 4.9 per cent in 1907, amounted to 4.7 per cent in 1912.

Table II published herewith shows for central electric stations and electric railways the kilowatt-hours of purchased energy, the amount paid therefor and the average cost per kilowatt-hour by the census geographic divisions in 1912. The names of the states composing the different divisions were given in the ELECTRICAL WORLD of Jan. 16, 1915, page 161. The total of 5,580,821,386 kw-hr. purchased brought an average rate of 0.8 cent per kw-hr. The highest rate shown for either class is for energy purchased by electric railways in the New England group of states, which averaged 1.5 cents per kw-hr. The lowest rate in the table is reported by central electric stations of the South Atlantic group of states, 0.4 cent per kw-hr.

Table III published herewith shows the primary power, kilowatt rating of dynamos, and output of stations by the main geographic divisions, with the totals for the United States, of central electric stations and electric railways combined in 1912 and 1907.

Except for dynamos in isolated plants and equipment in telegraph and telephone offices, comparatively small, the totals given for electric central stations and electric railway plants represent practically all the dynamos installed for commercial and municipal use.

TABLE II—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PURCHASED ENERGY, KILOWATT-HOURS, AND AMOUNT PAID FOR PURCHASED ENERGY, BY GEOGRAPHIC DIVISIONS—1912

Division	Total			Central Electric Stations			Electric Railways		
	Purchased Energy, Kw-hr.	Amount Paid for Purchased Energy	Average Cost per Kw-hr., Cents	Purchased Energy, Kw-hr.	Amount Paid for Purchased Energy	Average Cost per Kw-hr., Cents	Purchased Energy, Kw-hr.	Amount Paid for Purchased Energy*	Average Cost per Kw-hr., Cents
United States	5,580,821,386	$42,620,874	0.8	2,613,502 605	$18,074,344	0.7	2,967,318,781	$24,546,530	0.8
New England	232,382,012	2,813,501	1.2	136,821,236	1,394,330	1.0	95,560,776	1,424,171	1.5
Middle Atlantic	1,884,722,386	13,778,379	0.7	989,404,314	5,982,590	0.6	895,318,072	7,795,789	0.9
East North Central	1,073,512,511	9,584,184	0.9	276,742,512	2,933,041	1.0	796,769,999	6,651,143	0.8
West North Central	383,167,448	3,945,449	1.0	183,535,438	2,135,944	1.1	199,632,010	1,809,505	0.9
South Atlantic	656,623,987	3,207,015	0.5	407,716,658	1,831,265	0.4	248,907,329	1,375,750	0.5
East South Central	57,811,414	507,933	0.9	15,948,772	131,697	0.8	41,862,642	376,236	0.9
West South Central	92,487,788	952,253	1.0	38,763,468	311,664	0.8	53,724,320	640,589	1.2
Mountain	259,796,097	1,590,136	0.6	188,201,530	1,032,516	0.5	71,594,567	557,620	0.8
Pacific	940,317,743	6,237,024	0.7	376,368,677	2,321,297	0.6	563,949,066	3,915,727	0.7

*Includes a small amount paid for power other than electric.

TABLE III—CENTRAL ELECTRIC STATIONS AND ELECTRIC RAILWAYS—PRIMARY POWER, DYNAMO, RATING, AND OUTPUT OF STATIONS, BY GEOGRAPHIC DIVISIONS AND STATES—1912 AND 1907

Division and State	Census	Primary Power							Kilowatt Rating of Dynamos			Total Output of Stations, Kw-hr.
		Total Hp	Steam Engines and Steam Turbines		Gas and Oil Engines		Waterwheels		Total	Direct Current	Alternating Current	
			No.	Hp	No.	Hp	No.	Hp				
United States	1912	11,193,699	10,108	8,116,086	1,164	135,225	3,316	2,942,388	7,642,755	1,243,365	6,399,390	17,585,662,014
	1907	6,618,011	11,422	5,104,800	504	72,163	2,709	1,441,048	4,432,641	1,428,954	3,003,687	10,621,406,837
Geographic divisions:												
New England	1912	1,157,132	885	903,604	55	10,017	563	243,511	820,628	210,017	610,611	1,555,814,478
Middle Atlantic	1912	2,991,020	1,961	2,291,573	192	33,939	595	665,508	2,047,134	340,876	1,706,258	5,371,253,169
East North Central	1912	2,515,706	2,627	2,183,091	224	26,710	703	305,905	1,756,368	342,488	1,413,880	3,995,158,144
West North Central	1912	929,220	1,513	766,922	424	29,578	272	132,720	641,343	113,222	528,121	1,209,359,546
South Atlantic	1912	1,004,038	945	587,888	60	11,373	385	404,777	682,325	79,616	602,709	1,074,027,912
East South Central	1912	354,338	616	315,628	13	1,080	47	37,630	241,347	48,286	193,061	476,150,487
West South Central	1912	344,799	890	318,767	153	17,354	35	8,678	242,617	48,608	194,009	425,302,675
Mountain	1912	518,721	306	179,637	20	2,695	313	336,389	317,176	17,089	300,087	980,641,612
Pacific	1912	1,378,725	365	568,976	23	2,479	403	807,270	893,817	43,163	850,654	2,497,953,991

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Mercury-Vapor Rectifier.—O. KRUH.—An account of an investigation carried out a few years ago in the research laboratory of the General Electric Company by the author, partly in conjunction with Weintraub. The author discusses first the differences of behavior of the anode and cathode in a mercury-vapor lamp and the action of such a lamp when supplied with alternating current. Its use as a rectifier is discussed at some length, different methods of connection being described and methods of starting discussed. Finally, commercial types of mercury-vapor rectifiers are described.—*Elek. u. Masch.* (Vienna), Dec. 6, 13 and 20, 1914.

Lamps and Lighting

Liquefying Carbon in the Arc.—H. LUX.—A review of the researches by Prof. O. Lummer on the carbon arc. He made extended investigations of the temperature of the carbon arc by means of his interference pyrometer. He showed that the incandescent arc carbon radiates as a "gray" body. The true temperature of the evaporating solid crater of the positive carbon at atmospheric pressure is 4200 deg. absolute. The temperature of the negative crater is lower by several hundred degrees. When the atmospheric pressure is increased the temperature of the positive carbon increases, and even if the pressure is increased to only 5 atmospheres, the efficiency of the arc lamp is increased "enormously." At a pressure of 22 atmospheres impregnated carbons showed such a surface brightness that a temperature of more than 6000 deg. (temperature of the sun) is estimated to exist. If the pressure is decreased below one atmosphere the temperature of the positive crater decreases. The lowest temperature of the evaporating solid positive crater which was obtained in Lummer's experiments was about 3900 deg. absolute. At reduced pressure a peculiar phenomenon was observed which is considered by Lummer as the melting of carbon. This takes place especially at 0.5 atmosphere with a current a little lower than normal. What he observed is a movement of "fishes" in the "liquid." The "fishes" are assumed to be graphite crystals produced by melting of the carbon. That this phenomenon is really the melting of carbon is only a hypothesis, although not improbable. It is so far only of scientific and not of technical importance.—*Elek. Zeit,* Dec. 17, 1914.

Generation, Transmission and Distribution

Three-Phase System with Storage Battery.—W. VON WINKLER.—A long account of the development of the municipal electric station of Klagenfurt in Austria, and especially of the use of a storage battery in conjunction with a three-phase system and the technical and economical results obtained thereby.—*Elek. u. Masch,* (Vienna), Dec. 20 and 27, 1914.

Traction

Electrification of Berlin Elevated Railway.—ZEHME.—The Prussian Parliament granted in 1913 the sum of $6,250,000 for a preparatory investigation on the electrification of the Berlin Stadt-, Ring- und Vorortbahnen (Berlin Elevated City, Loop and Suburban Railways). Trials of the single-phase system are being made on the Dessau-Bitterfeld road. In the meantime greater interest is being taken in the development of the high-tension direct-current system, and it has been established that for the direct-current system trains consisting of motor cars and supplied with energy from a third-rail represent the most suitable system. A trial with this system will be made on a line from Wannsee to Stahnsdorf with direct current at 1600 volts. The experimental trains will consist of four motor cars, each with four axles, and six trailers. Current supply from overhead lines for a traction system, as used in the new installations of Buenos Aires and Melbourne is considered as antiquated. Not only for 1200 volts but for higher voltages the third-rail should be used. On the present trial line it is proposed to make arrangements so that it will be possible to have available not only 1600 volts but also 3000 volts.—*Elek. Zeit,* Dec. 24, 1914.

Installations, Systems and Appliances

Austrian Central Stations in War Time.—ED. PICK.—The author sketches the troubles of the Austrian central stations in war time. They must run continually, although the mobilization of the army has suddenly taken away managers, engineers and workmen. There is also a difficulty in the supply of the necessary materials. Less suitable coal must be used which can be obtained in the neighborhood. The American lubricating oils are missing. The stations operated with Diesel engines are in great difficulty on account of lack of oil, the price of which is four times that before the war. The operating cost is greatly increased, while the sale of electrical energy is somewhat affected. The contracts which were made with municipalities or private parties under normal conditions must now be adhered to.—*Elek. u. Masch.* (Vienna), Dec. 6, 1914.

Cab Signals on British Railways.—Illustrated abstracts of five papers presented before the British Institution of Mechanical Engineers. W. C. Acfield, signal superintendent of the Midland Railway, dealt with audible signaling on railway trains in motion; Leon P. Lewis, of the Caledonian Railway, with automatic signaling on trains; Vincent L. Raven, of the North-Eastern Railway, with an electrical system of cab signaling; W. A. Stainer, of the Great Western Railway Locomotive Works, with the combined automatic train control and audible signal system in use on the Great Western Railway of England, and W. Willcox, of the London Metropolitan Railway, with signaling on railway trains in motion.—London *Electrician,* Jan. 8, 1915.

Electric Locomotive.—An illustrated description of the electric connections on the 15,000-hp electric single-phase locomotive for the Midi Railway in France. The motors are of the compensated series type.—London *Engineering,* Jan. 1 and 8, 1915.

Trier.—H. HENNEY.—A long and profusely illustrated description of the electric generating station of Trier in Germany. This is a steam-power station containing one 180-kw and one 300-kw direct-current generator supplying energy to the direct-current system at 2×220 volts in connection with a battery of 266 cells with a capacity of 1000 amp-hr. There is also a three-phase generator of 1500 kw and another one of 1850 kw. The Dhorn water-power station contains three 1870-kw, three-phase generators. The total first cost of the power station and network was $2,000,000, the receipts in 1913 were $235,225, and the expenses $59,234, so that the net earnings were $175,991, or 8.74 per cent of the first cost. A review of the developments of the street railways is also given. It was taken over by the city as a horse-car line in 1902 and electrified in 1905.—*Elek. Kraftbet. u. Bahnen,* Oct. 14 and 24, Nov. 4 and 14, 1914.

Manchester.—An illustrated article on the energy-supply system of Manchester, England. At the present time energy is obtained from three generating stations —Dickinson Street and Bloom Street stations, which supply direct current in the center of the city, with a combined equipment rating of 14,000 kw, and the

Stuart Street station, in the Clayton district, which supplies alternating current at 6600 volts pressure to numerous substations and has an equipment rating of 55,500 kw. In connection with the Stuart Street station there are twenty-two substations—excluding those on consumers' premises—with an installed capacity of 33,000 kw. One of these is at Dickinson Street, where the generating plant was unequal to meeting the demand for electricity in the adjoining area. To meet the requirements of the large power users, the city corporation has also equipped fifty-eight substations on consumers' premises, with an installed capacity of 34,500 kw. A fourth generating plant is now to be erected to be available in 1917. The ultimate capacity of the new Barton station will be some 160,000 kw. The proposed equipment is described at length. As proposed the first four generating units will be turbine sets of 15,000 kw each, and the remaining four will be similar sets of 25,000 kw each, making a total of 160,000 kw.—London *Elec. Review*, Jan. 8, 1915.

Swiss Electrical Society.—A report of the meeting held in Berne on Oct. 25 by the Swiss Electrical Society jointly with the Association of Swiss Central Stations. Prof. J. Landray presided. The number of members of the Swiss Electrical Society is 1159. Committee reports were presented on heating and cooking apparatus, high-tension apparatus, oil switches and protection against dangerously high voltages. The Association of Swiss Electric Central Stations comprises 306 stations, and the buying bureau of the association reported that incandescent lamps were bought during the last ten years as shown in the table reproduced herewith.

INCANDESCENT LAMP PURCHASES FOR TEN YEARS

Year	Carbon Lamps	Metallic-Filament Lamps
1904/05/06	384,322	.....
1906/07	278,929	.....
1907/08	400,705	.....
1908/09	323,821	.....
1909/10	393,348	.....
1910/11	200,388	189,934
1911/12	165,511	547,377
1912/13	324,512	982,478
1913/14	165,382	1,073,274

The committee on protection against dangerously high voltages is working out a set of regulations.—*Elek. Zeit*, Dec. 24, 1914.

Wires, Wiring and Conduits

Feeder Protection.—A note on a recent British patent (No. 29,984, 1913) of the British Thomson-Houston Company, J. Whitcher and F. B. Wedmore for a protective system in which the feeder is composed of parallel connected sections, one surrounding the other. The relays and trips are arranged on a balance principle, the current in the two parts of the feeder normally balancing. Disconnection is effected when the current in the outer section predominates. The inner conductor may be of smaller section than the other, and the balance relay may be set with a bias in favor of the inner conductor.—London *Elec. Eng'ing*, Dec. 31, 1914.

Electrophysics and Magnetism

Theory of Gravitation.—A. D. Fokker.—A mathematical paper giving a concise account of the principal features of Finstein and Grossmann's gravitation theory, leaving aside as far as possible the mathematical complications but emphasizing the simple and fundamental physical points.—*Philos. Mag.*, January, 1915.

Absorption Spectra of Organic Substances in the Light of the Electron Theory.—N. P. K. J. O'N. McClelland.—The large number of experimental results now available has made it possible to trace a qualitative and quite empirical relation between the constitutions of organic substances and their absorption spectra. Thus it has been found that certain groupings of atoms are likely to give rise to bands in particular regions of the spectrum, but all theories which have hitherto been proposed to explain this fact appear to have postulated a characteristic type of vibration within each kind of group. In the present paper a theory is proposed which, starting from the atom, builds up the spectrum in a perfectly general way and makes it possible to predict the positions of absorption bands with reasonable accuracy from the constitution, given certain fundamental constants.—*Philos. Mag.*, January, 1915.

Radiology.—P. Lenard and C. Ramsauer.—The third annual report of the work of the Radiological Institute of the University of Heidelberg. The report first deals with physical researches on radiology, namely, cathode rays, photo-electricity, electric conduction in flames, positive rays, light emission, electricity at waterfalls, phosphorescence, radio-activity. The second part of the report deals with recearches on the uses of radiology in medicine.—*Elek. Zeit.*, Dec. 24, 1914.

Magnetization of Iron at High Flux Density with Alternating Currents.—J. S. Nicholson.—An abstract of a paper read before the Scotch section of the (British) Institution of Electrical Engineers. In the first part of this paper the author deals with the difficulties experienced in obtaining a simple sine wave of flux in the iron core of an alternating-current tester at high flux densities. If the flux does not so vary, it is difficult to determine its maximum value. The difficulty was largely eliminated in the experiments described by supplying the third harmonic from a separate source. An explanation is given of the presence of harmonics, and in the concluding portion the author deals with the relationship existing between the various harmonics in the magnetizing current.—London *Electrician*, Jan. 8, 1915.

Units, Measurements and Instruments

Measuring the Losses of Condensers.—August Hund.—An illustrated description of a differential method by means of which one is able to measure very small decrements of condensers up to the highest frequencies for both the damped and undamped waves. The author uses a differential transformer in which two equal coils 1 and 2 (Fig. 1) wound in opposite directions are placed over the secondary coil 3. The two differential primary coils have the same effective resistance, the same self-induction, as well as the same inductive effect on the secondary coil. In Fig. 1, C_x is the condenser

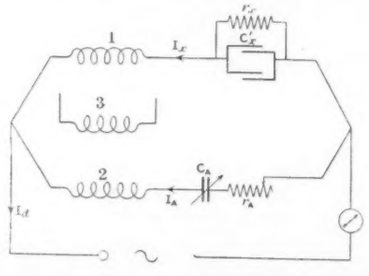


FIG. 1—ARRANGEMENT OF DIFFERENTIAL TRANSFORMER

under test—for instance, a Leyden jar, the dielectric loss of which is to be determined. It is compared with C_a, which is an air condenser which has no dielectric loss. The condenser C_x may be considered as a combination of an ideal condenser without dielectric loss with a resistance in parallel. Adjustment is made so that no current exists in the secondary of the differ-

ential transformer. The theory of the method of measurement is given. In order to determine when the current in the secondary of the differential transformer is zero, a "thermo-cross-bridge" arrangement is used, as shown in Fig. 2. "The thermo-cross bridge is based on the superposition of two currents, from which we assume the one as being constant. Suppose two equal

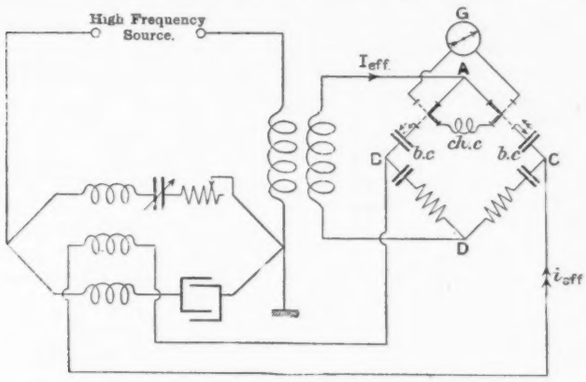


FIG. 2—"THERMO-CROSS-BRIDGE" ARRANGEMENT

thermo-crosses are inserted in the branches *AB* and *AC* of the bridge. There are then in each branch two thermal elements soldered together at one point. The heavy lines represent maganin wire and the dotted lines wire of constantan. The bridge is so balanced that the resistances of all branches have neither inductive nor capacity effects. The author finally describes how to determine the logarithmic decrement. The author found that the logarithmic decrement of an imperfect condenser is a constant for the same specific strain of the dielectric for all frequencies used in wireless telegraphy. Measurements carried out up to 0.5 amp condenser current have shown that the fictitious loss resistance is also a constant for a definite frequency.—London *Electrician*, Jan. 8, 1915.

Measurement of Thermal Conductivity of Tungsten, Tantalum and Carbon.—A. G. WORTHING.—A paper in which the author describes a method based on optical pyrometry for obtaining the thermal conductivity of certain solid substances at incandescent temperatures. The thermal conductivities of tungsten, tantalum and carbon were determined in the region from 1500 deg. K. to 2500 deg. K.—centigrade degrees above absolute zero. The results on carbon check well with results by Hansen. Values for the function k/xT (k thermal conductivity, x electrical conductivity, T absolute temperature) are determined for the same substances and for the same temperature ranges. Large temperature coefficients of the function were found, in contradiction to what would be expected from electronic theories. As a preliminary determination of the relation between the radiation intensity E and the absolute temperature T for tungsten, the equation $E = \sigma T^{\beta} =$, where $\beta = 5.35$ and $\sigma = 6.2 \times 10^{-17}$ watts/cm $^2 \times$ deg.$^{5.35}$, has been found to hold.—*Physical Rev.*, December, 1914.

Adjustable Rheostat.—R. G. VAN NAME.—An illustrated description of a rheostat of variable range suitable for large currents. The rheostat consists essentially of a curved rod of graphite submerged in water and so mounted that its effective length is varied by rotating an axle which serves at the same time as one of the current leads.—*American Journal of Science;* also reprinted in abstract in London *Electrician*, Dec. 4, 1914.

Silvering Quartz Fibers.—H. B. WILLIAMS.—An illustrated description of the method for silvering quartz fibers for use in delicate electrometers and similar instruments. The layer of silver is applied by means of the cathode spray. The silvering is effected by passing a direct current of about 0.012 amp through the tube in an atmosphere of dry hydrogen at a pressure of approximately 0.2 mm.—*Phys. Review*, December, 1914.

Selenium Cells.—L. P. SIEG AND F. C. BROWN.—A paper on wave-length sensibility curves of certain crystals of metallic selenium, and a partial explanation of the complexity of light action in selenium cells.—*Phys. Rev.*, December, 1914.

Reichsanstalt.—An account of the work of the German Physico-Technical Reichsanstalt during the year 1913.—*Elek. Zeit*, Dec. 24, 1914.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—A note on a recent British patent (No. 28,413, 1913) of Marconi's Wireless Telegraph Company, Ltd., and H. J. Round for a receiving system in which use is made of an oscillation valve detector consisting of a vacuum tube containing a hot filament, together with a cylindrical grid completely surrounding the filament and a third cylindrical electrode completely surrounding the grid. The oscillating circuit is tuned to a frequency slightly different from that of the received wave and is connected between the filament and the third terminal. The cylindrical form of the grid and third terminal prevents the glass becoming electrified by the cathode stream and producing polarization effects, and the slight difference in tuning enables signals produced by continuous waves to be heard in the telephone.—London *Elect. Eng'ing*, Jan. 7, 1915.

Telephone Statistics.—W. H. GUNSTON.—A statistical article on the telephone stations of the world at the beginning of 1913, with some statistics relating to 1914. London *Electrician*, Nov. 27, 1914.

Bell Signals in Mines.—THOMAS G. WATTS.—An article on electric bell signaling in collieries with special reference to a system which is safe in gas and air mixtures.—London *Elect. Review*, Jan. 1, 1915.

Miscellaneous

British Electrical Legislation.—A long editorial on electrical legislation in Great Britain in 1914. The outstanding feature of the 1914 session of Parliament, and of the new session which commenced in November, was the extraordinary output of emergency legislation and administrative regulations necessitated by the war. By the "defence of the realm" acts and the orders in council and regulations made thereunder the naval and military authorities have been empowered to control and (if necessary) take possession of and make use of means of transmitting intelligence, systems of transport, electricity supply works, lighting, etc. Another group of emergency acts and regulations relates to patents, designs and trade-marks, and (inter alia) they confer power to suspend the terms of patents held by alien enemies or to grant licenses under them to British manufacturers. Apart from the emergency legislation referred to above, there was only one new act of the 1914 session which affected the electrical industry. This was the merchants' shipping convention act, which confirms the international convention for the safety of life at sea, signed by the delegates to the London conference in January, 1914, and which introduced important reforms in regard to the use of radiotelegraphy and signaling apparatus on board ship. Forty-nine provisional electric lighting orders were issued by the Board of Trade and were confirmed by acts of Parliament. In regard to electricity supply bills, one of the features of the session was the number of gas companies which succeeded in obtaining powers to supply electrical energy.—London *Electrician*, Dec. 25, 1914.

Radio Lightning Rod.—B. SCILARD.—In contradistinc-

tion to the ordinary lightning arrester, one equipped with a disk provided with radium below the point of the lightning arrester has a larger sphere of action.—*Comptes Rendus*, Vol. 158, page 695, 1914; abstracted in *Elek. Zeit.*, Dec. 17, 1914.

New Zealand.—An article giving brief statistical tables of the imports into New Zealand of various materials and machinery from the United Kingdom and other countries. In another article an abstract is given of a recent report of the British Trade Commissioner, W. G. Wickham, dealing with the general trade position, criticism of British methods, methods of distribution, need for local representation in New Zealand, and the trend of import trade.—London *Elec. Review*, Jan. 1 and 8, 1915.

Book Reviews

ELECTRIC TOY-MAKING FOR AMATEURS. By Prof. T. O'Conor Sloane. New York: The Norman W. Henley Publishing Company. 210 pages, 77 illus. Price, $1.

An interesting and suggestive little book, presenting in a popular but not unscientific manner the essentials of various electric toys, instruments and appliances, most of which can be constructed with little difficulty by amateurs. The book must not be classed with certain compilations prepared for the consumption of inquiring youth in which the essential information is very frequently omitted owing to the writer being unfamiliar with the first principles of his subject. The amateur without technical training should derive both pleasure and profit from this book. As a gift for boys who delight in experimentation along scientific and mechanical lines it can be strongly recommended. The apparatus described includes primary and secondary batteries, permanent magnets and electromagnets, electric bells, small motors and generators, sparking coils, and other interesting and instructive electric toys, appliances and experiments. The chief value of the book lies in its undoubted power to nourish and stimulate the inquiring mind of the youthful reader.

EXPERIMENTS. By Philip E. Edelman. Minneapolis: Philip E. Edelman. 256 pages, illus. Price, $1.50.

This little volume claims to give " a complete account of experimental work in science, invention, the industries and the amateur field, with practical instructions and working directions." Although it cannot be said that the process of condensation has been carried to the point which would justify this claim, the book is unquestionably of value to those of an inquiring turn of mind who have the gift of originality and who "delight in doing things." The volume is divided into two parts. In the first part are described many simple experiments covering a wide range of subjects, from kite-making and simple chemical experiments to alternating-current transformers and a complete working model of a flour mill. The second part deals with the principles of research and invention and, although very short, contains much that is new and suggestive. The charm of the book lies less in the nature of the miscellaneous facts presented than in the personality of the author, which imbues the written page. If it be true that the value of a book, whether it deal with fiction or with science, lies in its power to evoke new thoughts and figures in the reader's mind, then this is a valuable book. It will not appeal to all classes of readers, but the spirit of optimism and scientific enthusiasm which pervades it, together with its ability to awaken and stimulate the normally somnolent mind, should insure for it a wide circulation among an appreciative circle.

PRACTICAL RATE-MAKING AND APPRAISEMENT. By William D. Marks. Published at the Office of the President's House, South Hadley, Mass. 270 pages. Price, $2.

This book was written by Mr. Marks shortly before his death with the intention of collating, digesting and systematizing what he called a new branch of engineering science, "rate-making and appraisement." In the preface there are some interesting views on commissions. The writer acknowledged indebtedness for practical data to the admirable reports of the Massachusetts Gas and Electric Light Commission, which "even in its lack of aggressiveness" "appears to have proved itself on the whole both safer and wiser than other commissions." The author criticised "partisan public service commissions" and expressed the belief that better results will be reached by a larger measure of home rule in metropolitan communities. The book includes several reports on rate cases made by the author and discussion on the various questions involved. With the exception of the reports mentioned, the book is mainly a presentation of the points of view tenaciously held by the author.

PRACTICAL ILLUMINATION. By Justus Eck. London, England: S. Rentell & Company, Ltd. 86 pages, 32 illus. Price, 1 shilling.

This small volume is simple in its character and the aim in its preparation has been to present in a practical way some of the problems confronting the lighting contractor and the user of electric light and to outline methods applicable to their solution. General features of illumination, including the matters of direct and indirect lighting, are briefly discussed, after which considerable very useful information is given under the heading "Planning of the Installation." This section includes several tables of data covering the illumination to be obtained with different numbers and arrangements of the standard electric lamps, but it gives rather undue emphasis to lighting by means of arc lamps. Some space is given to the cost of installations and the maintenance of lamps, and these data, of course, apply to conditions as they exist in England and cannot be used directly for American practice. A more complete index would prove useful in connection with this book.

MEHRFACH-TELEGRAPHEN. By A. Kraatz. Braunschweig, Germany: Friedr. Vieweg & Sohn. 228 pages, 212 illus. Price, 10 marks.

This book, the eleventh of a group on the technology of telegraphy and telephony edited by Chief Telegraph Engineer Karrass, of the German Post Office, covers the operating theory of several of the better-known systems of multiple high-speed telegraphing over lines. In a brief introduction consideration is given to the general features of multiple transmission, which are not treated in the text because of their disuse at the present time, and mention is made of the work of Picard and Mercadier. The remainder of the book is divided into two sections, relating to the two broad methods depending, respectively, upon distribution of operating time between several pairs of instruments and upon simultaneous working. Each part is opened with a discussion of the fundamentals of the system considered. To the Baudot apparatus are devoted the remaining 111 pages of the first section, while in the second part are described the duplex methods depending upon differential action and upon bridge connections, including the arrangements of Klopfer, Hughes, Wheatstone and Siemens-Halske. In an appendix the author discusses effects of resistance, inductance and capacity and current distribution in the several systems, and concludes with descriptions of the Murray and Rowland telegraphs.

POWER AND OPERATING SECTION

Automatic Control of Step-Bearing Oil Pumps

As the oil for step bearings in the Gold Street station of the Edison Electric Illuminating Company of Brooklyn is forced through filters and used over and over without replenishing, it is extremely important that the circulation be not interrupted. Duplicate motor-driven centrifugal pumps are therefore employed with each step-bearing oil-receiving tank, only one unit normally pumping oil to the filters, but in case it becomes inoperative the reserve pump is automatically substituted. The construction of the receiving tank and the mechanical connections of the pumps are shown in the accompanying drawing and illustrations.

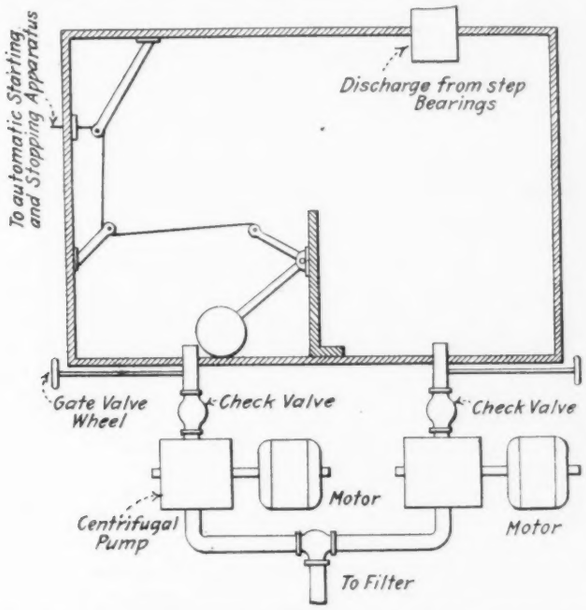


FIG. 1—AUTOMATICALLY CONTROLLED STEP-BEARING OIL PUMPS

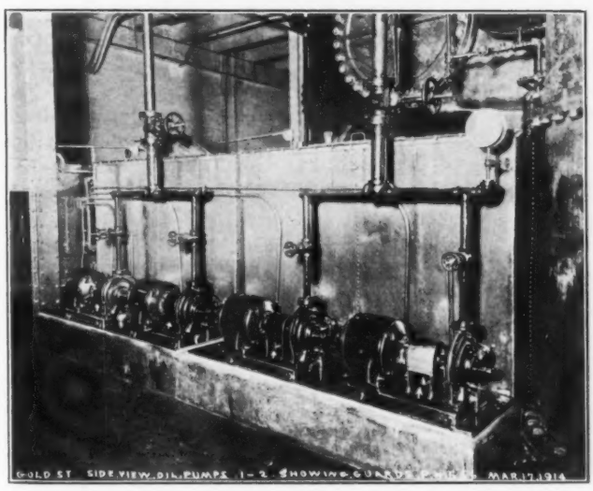


FIG. 2—TWO SETS OF DUPLICATE STEP-BEARING OIL PUMPS

The tank is divided into two compartments by a low partition. Oil from the step bearings discharges into the right-hand compartment and is removed normally by the pump connected thereto. This pump is running all the time, and should the oil accumulate in this compartment it will eventually flow over the partition into the left-hand compartment, thereby raising a float which starts the reserve motor.

Both pumps discharge into a common pipe leading to the filters. To prevent one motor pumping back through the other, check valves are installed in each pump circuit. Gate valves are also installed in the suction pipes of each pump to facilitate repair work in case either pump requires it. Each pump is amply capable of removing oil from the tanks at twice the rate it is delivered.

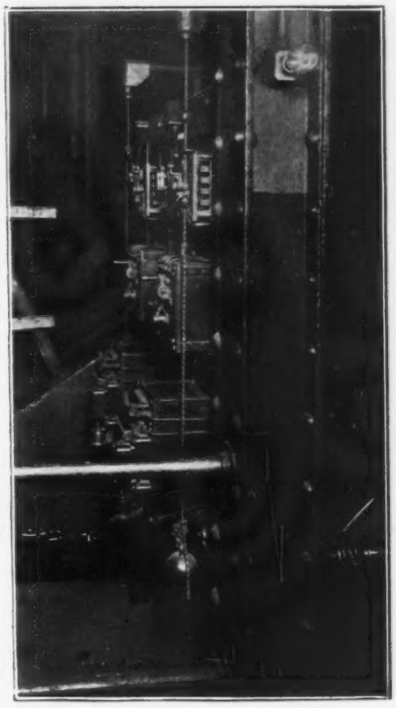


FIG. 3—APPARATUS CONTROLLING OIL-PUMP MOTORS

Cooling-Water Pond and System for a City Substation

BY FRED BUCH

A somewhat novel system with unusual features for water-cooling the oil-immersed transformers in a substation, recently designed and installed, is described below.

The substation is a building approximately 40 ft. by 60 ft. in plan, with an additional 10-ft. by 14-ft. space for overhauling and erection purposes. It is situated in the city served. Energy is transmitted from the main station some 12 miles distant, and the pressure is stepped down from 44,000 volts for distribution. The present installation of apparatus consists of three banks of transformers, while two more banks are to be added at a future date. The present banks are made up of three 2000-volt, two 1000-volt and four 500-volt transformers of the oil-immersed type. The future installation will consist of five 2000-volt transformers. All apparatus will be water-cooled. The total amount of cooling water for the present installation was stated by the makers as 115 gal. per minute, and the temperature rise of the water due to the heat in the transformers as 18 deg. Fahr. For economic reasons recooling and re-use of the water were decided upon and a storage pond was provided. A narrow strip of ground which, owing to its exposure to floods and its

disadvantageous location, could be of little use for other purposes was reserved for the pond. The water supply for the latter was taken from a near-by canal.

Re-cooling was effected entirely by spray nozzles, the pond serving merely as a basin large enough only to catch the spray. The pond water was used for no other purpose than transformer cooling, and a loss of only 2 per cent, due to wind and evaporation, was anticipated. A diagrammatic plan of the piping is

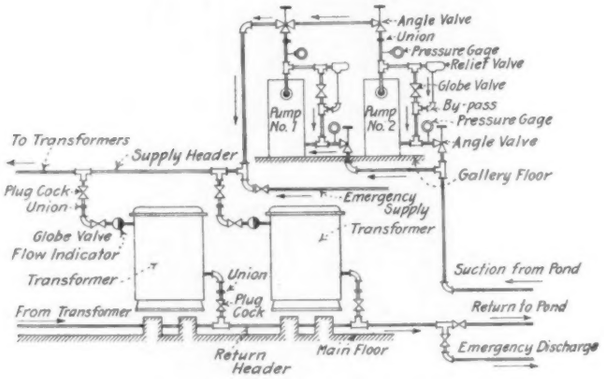


DIAGRAM OF PIPE CONNECTIONS

shown in the accompanying illustration. The dimensions are, of course, greatly exaggerated to give clearness.

Pumps

Two 4-in. by 6-in. Dean triplex plunger pumps of 60 gal. capacity each were installed. They were rated with a discharge head of 80 ft. and a suction lift of 10 ft. and were geared to 3-hp motors of the direct-starting type. These pumps were installed on a gallery floor, 6 ft. above the main floor on which are the transformers and approximately 2 ft. above normal water level in the cooling pond. This elevated location was necessary to prevent the pumps from being flooded at high water, the flood waters rising at times almost 4 ft. above the main floor. No pump foundations were provided, but the bedplates were lined up with a 1-in. grouting directly on the floor. The holding-down bolts pass through the 6-in. concrete floor slab with 4-in. by 4-in. plate washers on the under side. Holes for these bolts were drilled to suit the pumps and the bolts were afterward grouted fast. The pumps have 3-in. suction and a 2.5-in. discharge pipe and in this case are arranged for tapped connections only. It is essential, however, to have the connections flanged, with companion flanges, as at times it is impossible to use unions to advantage owing to the crowded conditions and the close pipe connections. The suction ends at the pumps are cross-connected to a common header, as are the discharge ends, and cut-out valves are placed where they can easily and quickly be reached by the operator, so that in case one pump or pump motor breaks down the other may be brought into action instantly without the operator leaving the gallery floor. As the entire system is a pressure system with no gravity flow, this plan was very essential. The pressure in the discharge line was fixed at 6 lb., this being all that is necessary to effect the required cooling at the spray nozzles. To increase the pressure above this value would simply circulate the water faster than necessary and spray it to a greater height, wasting it over the walls of the pond.

The cut shows diagrammatically the connections at the pumps. Unions are placed between the cut-out valves and the pumps as shown, so as to enable the overhauling or removal of a pump while the line is under pressure. A by-pass connection from the discharge end of each pump back to the suction side is provided, and this is used in starting the pump. This connection is further fitted with a pressure relief valve and a discharge around the cut-out valve in the by-pass, this arrangement relieving the line at the desired pressure and returning the surplus water back to the suction end of the pump. A pressure gage and suction gage are fitted to each pump as shown.

It will be noted that the pumps draw directly from the cooling pond, discharge to the transformers, and force the water on through to the spray nozzles at the pond, thus forming a complete cycle. For emergency purposes, however, a direct connection was provided to the city system from the distributing header, on the discharge side of the pumps, and an emergency discharge was provided from the return line to the sewer. It was thus possible to cut out the pond, should the latter require overhauling, and it was also possible to dispense with both pumps entirely, should they break down simultaneously. This latter condition is hardly to be expected, but the possibility of the pond needing a cleaning or waterproofing is not so remote. These emergency connections were made at a very small expense. The connections from the suction and discharge headers to the pumps were made with more or less flexible joints, so that crawling of the headers would be taken up by the leverage in these connections and in no way cause a strain on the pumps.

Transformer Connections

The two cooling-water headers and the waste-oil header are carried directly on the floor at the rear of the transformers, where they are entirely out of the way. This eliminated pipe hangers and stools, and therefore made an economical arrangement that was easy to install.

The transformers were set on rails, mounted on concrete piers. The latter are 16 in. in width in order to allow ample concrete over the holding-down bolts and the washers. The distance from the finished floor line to the top of the rail was kept 18 in. throughout to meet the height of the transformer transfer truck. This uniformity in height not only greatly facilitates removal of apparatus to the truck but provides liberal allowance and a very good arrangement for connecting up and leading away the large oil drain pipe from the bottom of the transformers. The heaviest transformers are the 2000-volt type. These, including the oil, weigh about 45,000 lb. and therefore require not less than a 60-lb. rail. To obtain uniform construction use was made of the 60-lb. rail throughout on all piers, without regard to the weight of the smaller apparatus.

The oil drain pipe, being installed with the water piping, may also be described here. The drain connection from the larger transformers was fitted with a 2.5-in. flanged angle valve which was supplied with the apparatus. Connection thereto was made with a companion flange and heavy paper gasket soaked in shellac. By using an angle valve a shorter and closer connection could be had than with a valve of the straight-way type. The disadvantage is of course that the valve cannot be opened so quickly in an emergency. However, transformer fires are of such rare occurrence, and the apparatus in this case so small, that angle stop valves were considered amply safe. The oil-header connection and also the water-pipe connections were made in branches more or less flexible, as it is less work to turn or swing the pipes at the joints to meet the transformers than to jack the heavy apparatus over to meet the pipes.

The cooling-water supply and return headers being

under pressure, plug cocks and unions were fitted in the branches next to the headers. This arrangement will allow cutting out any of the transformers and removing them from the line when overhauling becomes necessary, without interfering in the slightest with the system. Plug cocks were used in preference to valves as they are cheaper and give the full opening of the pipe. They are, however, used only to cut out the apparatus from the line. For throttling the flow in the supply line a globe valve is fitted next to the union. A flow indicator is fitted between the globe valve and the inlet connection on the transformer to indicate to the eye a sure flow of water. Where a transformer has more than one cooling coil a separate valve and indicator should be fitted for each such coil, and a plug cock should be provided in the discharge line from each coil. This is necessary to allow frequent cleaning of the reading glass on the flow indicator, which could otherwise not be done on a pressure system unless both water lines were temporarily shut off.

An oil header for filling the transformer tanks was not considered necessary, the tanks being filled through a 7-in. portable filter press and pump, driven by a suitable motor and fitted with an electric drying oven for the blotters. The extra oil supply, if any, is to be kept in barrels, and therefore it was not necessary to provide a storage tank.

Cooling Pond

As stated before, re-cooling is effected through spraying the water into the air, the surface contact of the pond water with the air not coming into consideration. A smaller pond area is thus obtained. The pond serves as a basin only, and the spray area of the nozzles determines the minimum width or diameter of the pond. This minimum was fixed at 40 ft. by the makers of the nozzles. The pond was made octagonal in shape and the inclosing walls were brought to 6 in. above the maximum known flood-water level. The inside nominal depth of the pond was fixed at 2 ft. 8 in. This depth, however, was purely arbitrary. The sides and bottom are 12 in. thick and are reinforced against temperature cracks with No. 27 triangle mesh. One-two-four concrete was used, and a 12-in. thickness decided upon. As the pond is subjected to flood waters and an upward pressure, the concrete was set on filled and hard tamped ground. It was waterproofed with a 1-in. coat of cement and sand in the proportion of one part cement to three parts sand.

A cluster of five spray nozzles, connected to the discharge line, was fitted at the center of the pond. A sump 2 in. deep was provided and the bottom was graded toward this sump. The pump suction pipe from this sump was fitted with a brass strainer at the end. In addition a box strainer was fitted in the line and provided with a by-pass connection to be used while the strainer is being cleaned. Water for the cooling pond was taken from the canal through a Kinney rotary pump of 10-gal. rating, with a discharge head of 50 ft. and a suction lift of 10 ft. This pump was installed outside of the station. It was connected to a 1-hp direct-starting motor. The pump was provided with a by-pass from the discharge side back to the suction. The suction end in the canal was fitted with a 0.75-in. foot-valve and strainer. The discharge was piped to a small flow-regulating tank and then to a sand filter into which the amount of flow was regulated by an automatic regulating valve. From the filter the water was piped to the pond. Owing to the very small loss of water (2 per cent to 5 per cent), this pump will be in operation only a part of the time. There are no connections other than the cooling system from this pond, the washrooms being in an adjacent older station.

Piping, Valves and Fittings

The water piping is of standard galvanized wrought-iron pipe, and the waste-oil header is of standard black wrought-iron pipe. Screwed fittings and screwed unions made with ground joints are used throughout. The flanged connections from the oil header to the angle valves on the transformers are made with standard flanges and heavy paper-ring gaskets soaked in shellac. The valves for the waste-oil header are of the standard screwed straight-way type, with outside screw and yoke. Those for the water headers are standard screwed globe or angle valves where throttling of the flow is essential; in other places plug cocks were used. The suction header from the cooling pond to the pumps is of 3.5-in. pipe; the return line of 3-in. pipe. The emergency connection from the city main to the supply header could not be made larger than 2.5 in. The emergency discharge, however, was made 3.5 in. to conform with the return header. The box strainer was made with a 6-in. inlet and outlet to provide a free flow of water through the brass gauze of twenty mesh. Special flanges were provided to connect to this strainer. The by-pass around the strainer was made 3.5 in. to conform with the suction header. The oil header from the transformers is of 3.5-in. pipe, and is carried to a convenient point outside of the building, where the broken-down oil may be finally wasted.

Choice of Right-of-Way Saves Money

The 2300-volt lines from the hydroelectric station at Rock Falls, Ill., which carry energy to the nearby city of Sterling are required to cross the double-track railroad which runs parallel to the river. An overhead crossing might have been made by using high poles set in the low ground on each side of the railroad, but to

LINES UNDER THE RAILROAD INSTEAD OF OVER IT

avoid the excessive expense and the hazard which such a crossing would entail, an "underground" right-of-way was selected, as shown herewith. A culvert constructed by the railroad to drain a deep gully not far from the station offered a safe passage for the wires and was free from the difficulties presented by other paths. Accordingly the lines were strung along the railroad to the culvert and then taken under the railroad on cross-arms suspended by means of braces anchored to the stone arch overhead.

Apparatus for Determining Voltage at Feeder Taps in Network Systems

By running pilot wires from each feeder tap in its direct-current network system to a pressure cabinet in its substations the Edison Electric Illuminating Company of Brooklyn, N. Y., has enabled its operators to tell the voltage at different points in the system. In-

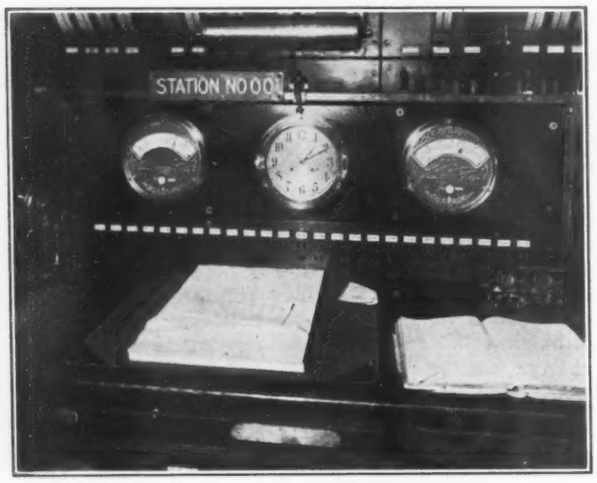


FIG. 1—OPERATOR'S PLUG-BOARD FOR DETERMINING FEEDER-END VOLTAGES

stead of keeping the station busbar voltage constant, the operators maintain a constant pressure at the feeder tap-in points. Four different voltages are maintained in the station on as many busbars for raising the pressure at the distant feeder ends.

On the pressure panel are two voltmeters showing the pressure on opposite sides of the neutral wire. For connecting these instruments to any feeder a plug board is employed. It is installed below the instruments and at the back of the operator's desk. Arranged across

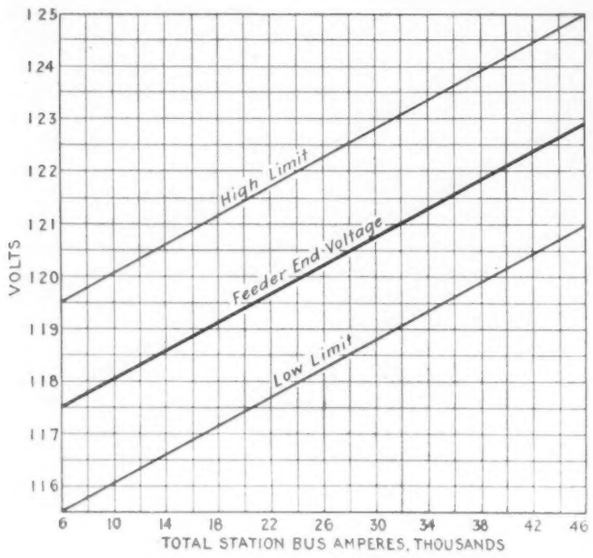


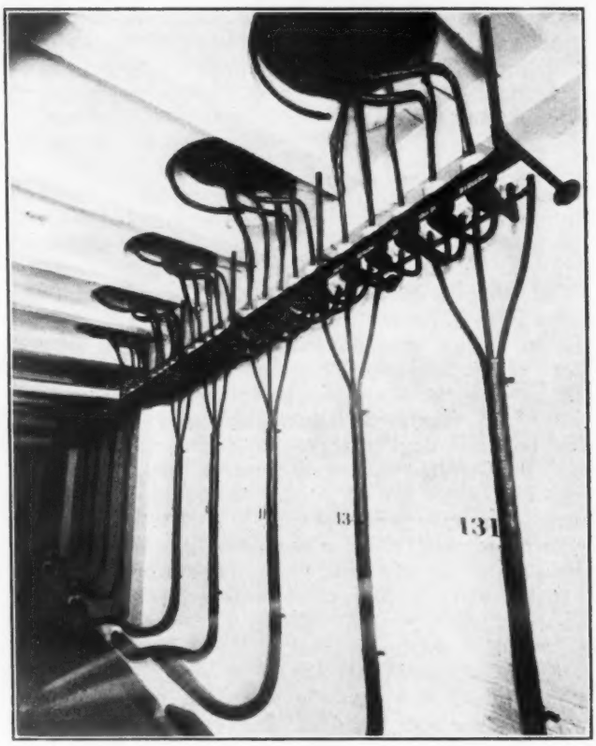
FIG. 2—PEARL STREET FEEDER-END VOLTAGE CHART

the panel are three horizontal rows of receptacles for receiving the contacts of a three-contact plug which can be inserted by the operator. It is considered by the operating department of this company that the best location of the panel is at the back of the operator's desk, as it is there that the station log sheets and all reports are made out.

In order to determine what voltage should be maintained at the feeder end or tap-in point it is necessary to know the drop in the network and the characteristics thereof. Curves taking these facts into consideration have been plotted for and installed in each station. All the operator has to do is to consult the chart, and by observing the voltage-current curve he is able to read the voltage which should be delivered at the feeder end to maintain the proper pressure in the network. The chart also shows the maximum and minimum voltage which should be applied to the feeders.

Arrangement of Feeder Cables Leading to Underground Ducts

Entrances to underground ducts leading from stations should be arranged so that additional outgoing or incoming feeders may be readily installed or the route of existing cables easily traced thereto. The accompanying illustration shows how these advantages have been obtained at the 187th Street substation of the



CABLES LEADING FROM REGULATORS TO UNDERGROUND DUCTS

United Electric Light & Power Company, New York City. Ducts connecting with the underground system are installed along the floor of a passageway running parallel to and directly below the feeder regulator compartment. Separate runs of the duct nest terminate under each regulator. The cables from the latter pass through the floor of the regulator room and connect with the outgoing-feeder potheads, which are supported on a steel framework just below the ceiling of the duct compartment. From the potheads the cables run down the wall and follow a gradual curve to the entrance of their respective ducts. These portions of the cables are wrapped with asbestos and protected with a spiral covering of galvanized-iron ribbon which is painted red, this being the color adopted by the company for its distributing feeders. The entrances to the ducts are sealed with concrete, On the wall beside each cable is painted in black the number of the feeder.

COMMERCIAL SECTION

Manager's Private Data Book

One successful central-station manager in the Middle West keeps a very interesting pocket data book for his own personal use. In it are recorded up-to-the-minute data on the valuation of his property, the property tax, plant equipment, plant output, curves showing the trend of rates, output and earnings, tables following the trend of different classes of business based on long years of actual experience, and many other instructive tables and curves which are always kept up to date and which can be used to refresh the manager's memory at an instant's notice. When asked how he determined what he should put into such a book, this manager said: "I keep in that book the things I need to know. When I leave town I put that book in my grip or my pocket, and if anyone at our central office asks a question, I answer it with specific and accurate data, always from the book."

In size the book is small, so small in fact that it seems impossible that it can contain so much information. It measures about 8 in. long by 4 in. wide, and is now about 1 in. thick with black leather covers. The secret of its compact construction lies in closely tabulated typewritten data on loose leaves. Tables can be revamped if necessary. The curve sheets and larger tables are sometimes folded.

Mr. E. N. Hurley on Price Cutting

Mr. E. N. Hurley, president of the Illinois Manufacturers' Association, in a recent paper giving his general impressions of the foreign trade situation, placed especial emphasis on the evils of price-cutting, saying:

"One of the reasons why the German, English, French and other Europeans have succeeded in getting the large contracts to furnish the South American countries with most of their electrical material and appliances is because the Europeans have been engaged in their respective businesses for a number of years. Their plants are well organized and they are most thorough in arriving at the actual cost of producing their goods, as well as at the cost of selling them. Having this information almost at their finger-tips, they know absolutely what quotations to make whenever an order is to be placed in any foreign country.

"The American manufacturer has been busy at home making a substantial profit on a small gross business and has been rather indifferent about increasing it so long as his profits were reasonably large. But the day of large percentages of profits on a small gross business is over. To-day competition is more keen, and if we want big profits we must find them in big volume. To get this increase in volume of sales we must go into the foreign markets. All of us are anxious to increase our business, but too many of us are inclined to pay undue attention to what our competitors are doing, borrowing trouble about dull times and worrying over the future of our country. If we paid more attention to our own affairs, we should have ample time to ascertain the actual cost of producing our goods and the cost of selling them. If we were to put our houses in order, get at the real facts regarding the cost of our products, establish up-to-date methods of accounting, charge off liberally for depreciation and present balance sheets in accordance with good business practice, we should be in a position to compete with any country in the world in any market of the world. The manufacturer who does not know what his goods cost is generally the fellow that is cutting prices and demoralizing the industry in which he is engaged."

Courtesy to Business Callers in the Outer Office

The value of a pleasant reception and of courteous and businesslike treatment of visitors in the offices of electrical concerns was emphasized by Mr. Frederic P. Vose in a recent talk before the Chicago Jovian League. Relating his experiences at the offices of two Chicago electrical houses, Mr. Vose told how at the first of these places, after waiting some time, he was finally able to attract a portion of the attention of the young woman at the telephone switchboard. The remainder of her attention was divided between her chewing gum and two messenger boys waiting for telegrams. She finally managed, however, to say to Mr. Vose, "What'll you have?" He replied, "When you are sufficiently at leisure I should like a little courteous attention," and, presenting his card, he continued, "I should like to speak to Mr. Blank." Inasmuch as the man named was one of the officers of the company, the girl stopped talking to the boys long enough to say that Mr. Blank was busy but would see Mr. Vose in a minute.

In direct contrast to this reception, however, was the polite and respectful greeting Mr. Vose received at the second electrical concern. The woman at the door, as the caller entered, said, "Good afternoon, Mr. Vose. Mr. Dash is here. He is not engaged. Will you be seated?" Her manner was that of the refined business woman which always commands respect. She had remembered the name of the caller, although he had been there but once before. She remembered on whom he had called before, knew that Mr. Dash was not engaged, and made the visitor feel at ease by asking him to be seated.

The difference between the two experiences had been so marked that the speaker made inquiry concerning the woman at the second concern. Mr. Dash answered by saying that the woman in his outer office received the highest salary paid any woman employee of the company. She was picked for the position because she was alert-minded and naturally of a courteous disposition.

Mr. Vose also referred to the need for greater courtesy in telephone conversations, driving his point home forcibly by asking his audience, "What kind of man does 'central' know you to be?"

Manufacturers' Prices Converted to Jobbing Basis

In estimating the cost of obtaining electrical equipment made by different manufacturers, contractors and dealers have usually had to refer to lists of prices subject to different discounts. If a variety of materials is to be purchased, such as wire, porcelain, fixtures, etc., computing the total cost may require considerable time. The Western Electric Company, 463 West Street, New York City, has therefore prepared for distribution among contractors and dealers a catalog in which all manufacturers' prices have been converted to a jobbing basis with uniform discount. From this list purchasers can quickly add up the prices of all articles desired and deduct the discount, thereby simplifying the work of their estimating, purchasing and billing departments.

Included in the catalog is a list of selling helps which the jobbing company will furnish to any dealer. Among helps offered are suggestions for window displays, lantern slides, literature describing electrical apparatus and electros for newspaper advertisements and street-car cards. The book contains 1200 pages besides an alphabetical index. Revised editions of the catalog will be issued at the beginning of each year.

A Window Display for the Central Station

BY F. S. ROOT

It is becoming more and more difficult every day to prepare a window display suitable for central-station use that will be original and attractive without going to considerable expense. The following display, however, although it took some time to prepare, was very

FIG. 1—DISPLAY WINDOW

inexpensive, being built almost entirely of cardboard and colored paper, braced with wooden strips. Like every moving display, it created a good deal of interest.

Although the photograph does not show the details as well as could be wished, it will be noted that the display consisted of a large model of a generating station, having on its roof a "winking" electric sign, with the front cut away, revealing the moving part of the display.

Upon an endless belt, driven by a small motor, were mounted a constantly moving line of factories and mills, interspersed with "billboards," each one bearing one or more words of the query "Why not let us run your plant by electric power?"

A background of trees and sky, cut from "landscape" wall-paper, and a sunset glow produced by colored lamps

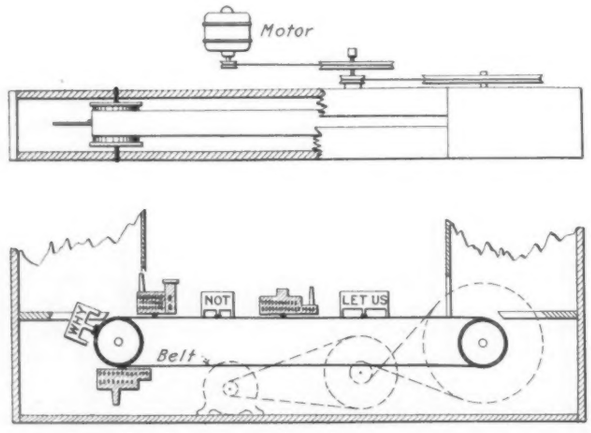


FIG. 2—APPARATUS FOR MOVING DISPLAY

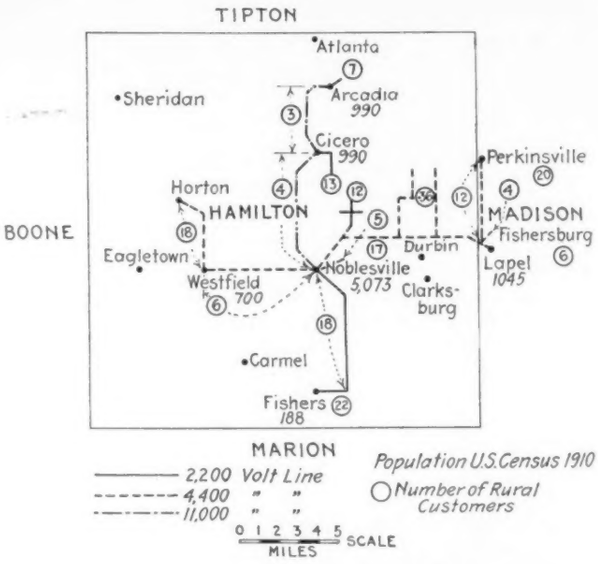
concealed above the endless belt gave a natural touch to the scene. Some of the mills were painted to represent red brick, while others were of gray stone.

Motors of different types and sizes were grouped about the front of the show window, and raw cotton was scattered about, as the cotton mills were the ones it was desired to interest. The accompanying drawing illustrates the manner of mounting the little buildings (which were sawed from thin board) upon the endless belt.

Growth of Rural Electric Service at Noblesville, Ind.

Outside of the incorporated cities and towns and the township in which Sheridan is situated, Hamilton County, Ind., has a population of 13,868. All of these inhabitants and about 2000 more in Madison County, it is confidently expected, will eventually be served from the central station of the Noblesville Heat, Light & Power Company. Originally a few farm customers were connected to the company's transmission lines between the small towns served, but within the last two years a definite policy has been pursued to develop rural business. The map herewith shows to what extent the company has been successful in covering the county with its lines.

The contract under which these lines were built provides that the company shall build and maintain a line where a minimum of four customers a mile is available. Each customer pays the company $50 toward the ex-



SYSTEM OF NOBLESVILLE COMPANY

pense of this line and later has the entire $50 refunded to him in electrical energy. Each customer pays for and maintains his own transformer, service connection and wiring. Primarily the customer figures on lighting only and he estimates his expense about as follows:

Interest lost on deposit	$6
1-kw transformer and service connection	50
House wiring (minimum)	50
Total	$106

Against this expense he considers an acetylene lighting outfit costing from $100 to $250. With the electrical equipment, however, he has the advantage of being able to use irons and motors, and hence the company's farm customers have grown in number this year to 214. Twenty-three of the customers have been connected to the company's lines for a full year, and the average income from each of these for the first twelve months was $17.58. As revenue for the first year this amount is considered satisfactory but not profitable. It will become profitable as these customers' demands increase. This average is really notable in view of the fact that the company's minimum bill is but 50 cents a month.

Co-operative Power Customers' Display at Hartford

To increase the good-will of its industrial customers and spread abroad the knowledge of the extensive use of central-station service in the manufacture of local products, the Hartford (Conn.) Electric Light Company is running a series of interesting exhibits in one of

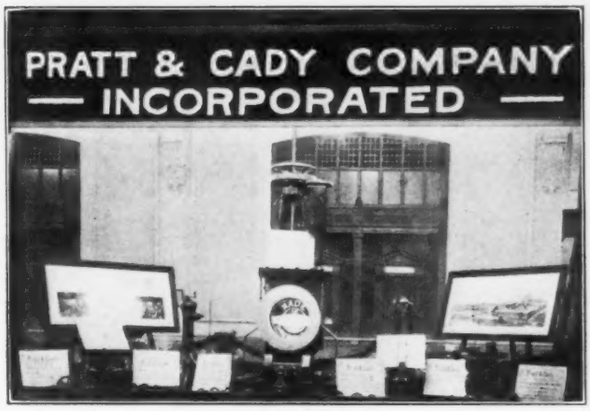


FIG. 1—VALVE MAKER'S DISPLAY

the show windows of its new office building. The window space is given free of expense to each customer, including all the electrical energy required to operate and to illuminate the displays, and customers are booked for one week. Prominent local concerns have taken enthusiastically to the plan of thus showing their products to the public, and these industrial "attractions" are booked up to March 20, 1915, with more to follow. The lighting company's only advertisement in the window is a transparency 15 in. square equipped with a 40-watt lamp illuminating the slogan of the campaign, "Made in Hartford, U. S. A., with Central-Station Power." Among the exhibitors have been the Mantermach Company, engraver, a concern formerly not well known to the community on account of the inconspicuous location of its offices, which received a one-hundred-and-fifty-dollar order as a result of the display; the Royal Typewriter Company, which exhibited with its products a

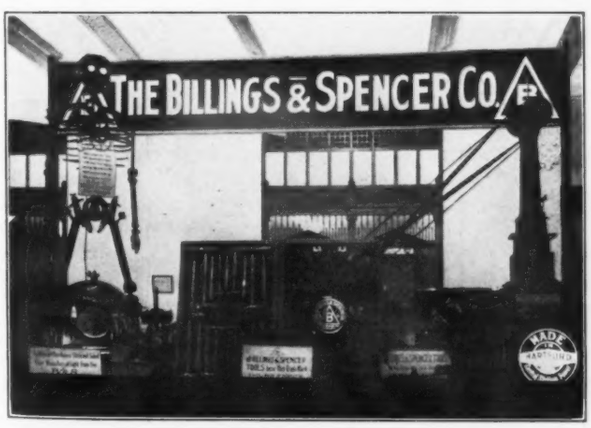


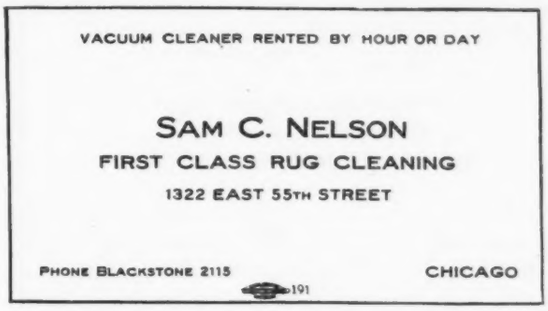
FIG. 2—DROP-FORGING DISPLAY

motor-driven enlarged machine costing $2,000, with a salesman on duty; the Maxim Silencer Company; the Arrow Electric Company, maker of sockets and wiring specialties; the Billings & Spencer Company, manufacturer of drop forgings, and the Pratt & Cady Company, valve maker.

The Billings & Spencer display featured a realistic skeleton made of drop forgings, with an electric "eye" which was caused to wink frequently at passers-by by means of an automatic socket switch. The Pratt & Cady display showed among other subjects a motor-operated valve which exposed and concealed the campaign emblem as the gate was opened and closed. The name of the exhibitor in each case is set forth by a transparency extending across the window front and illuminated by six 60-watt lamps mounted in front of reflectors at the rear. Practically no limitations are placed upon the customers arranging these exhibits, but so far as possible they are planned to show the interior of the company's salesroom as a background for each display.

Electric Vacuum Cleaner Rented by the Day

A big, husky negro, who runs a combination shoe-repair shop, shining parlor and rug-cleaning establishment in Chicago, owns an electric vacuum cleaner valued at $125 which he rents to his customers at $2 a day. For $1 an hour he will supply the machine and the services of a man. In either case energy is taken from the customer's own meter circuit. An inquiry about the cleaner set the shine-boy and salesman talking. "Do you-all live in dis neighbo'hood?" he asked. "Ah certainly mus' han' you one of my cahds, an' Ah hope you-all will call on me when youah house needs



CARD OF MAN RENTING VACUUM CLEANERS

cleanin'. Ah has lots of regular customers." The card which he presented is reproduced herewith, the thought being that perhaps electrical interests might profit by supplying both the cards and the cleaners on a time-payment plan to men operating small businesses in the residential districts of cities.

Wichita (Kan.) Mill Uses 4.5 Kw-hr. per Barrel of Flour

The new-business department of the Kansas Gas & Electric Company, Wichita Kan., has been very successful in securing flour mills as electric-service customers. A total of five mills are now connected to the company's lines. One of these, at Wichita, makes about 950 bbl. of flour a day. At this particular mill a 250-hp slip-ring motor drives the milling machinery through rope drives, counter-shafts and belts. The remaining electrical equipment consists of a 50-hp motor driving an elevator, a 7.5-hp motor driving a man hoist, and a liberal supply of tungsten lamps in enameled-steel reflectors. The mill is in operation twenty-four hours a day, and since the men have become accustomed to the new and modern machinery it has been possible to produce a barrel of flour with the consumption of 4.5 kw-hr. When the mill was new the records showed an average specific consumption of 4.9 kw-hr. per barrel.

Mr. T. Harvey, sales manager of the electric company,

says that with the company's rates as they are, requiring a fixed charge of $1.50 per kw of maximum demand and an energy charge varying from 7 cents per kw-hr. for the first 100 kw-hr. a month to 6 mills per kw-hr. for all energy over 35,000 kw-hr. a month, the average rates earned by the mills on the company's circuits range from 0.9 cent per kw-hr. to 1.5 cents per kw-hr.

Electric Consumer's Ledger Sheets

The Consolidated Gas, Electric Light & Power Company of Baltimore will place in use next March a new set of ledgers to record all consumers' accounting, energy service and merchandise sales for the four years beginning March 1, 1915. A reproduction of the sheet as finally adopted after going over all suggestions from group heads is given herewith. The sheet is 13.5 in. high by 15.75 in. wide and possesses the following advantages:

Merchandise is billed simultaneously with electric service on the same bill with a minimum of additional labor and great clearness in original record.

The debiting and crediting of the service charge and merchandise are so recorded as to avoid any uncertainty in analysis or issuance of statements from the account. The three separate credit columns will especially aid in maintaining the clearness of the ledger from an analysis standpoint.

The method of recording the principal sum under deferred-payment sales is novel yet very satisfactory, as these entries could not be recorded in the body of the sheet without confusing other billing.

The billing of "other charges" is executed at a minimum of labor and space. This is made possible through a system of billing such charges in detail on a separate bill attached to and listed on service bill in total only, a copy of which is retained in the office for detail reference when desired.

The changes in service-billing factors and meters are satisfactorily recorded, thus placing before the billing clerk all data necessary to effect the accounting for the month's electric service from skeleton bill received from stenographic department, bearing readings, difference and constant.

The three "paid" columns for posting credits under current sales, deferred-payment sales and other charges are a guarantee that analyses of payment can be readily made and balance due quickly determined.

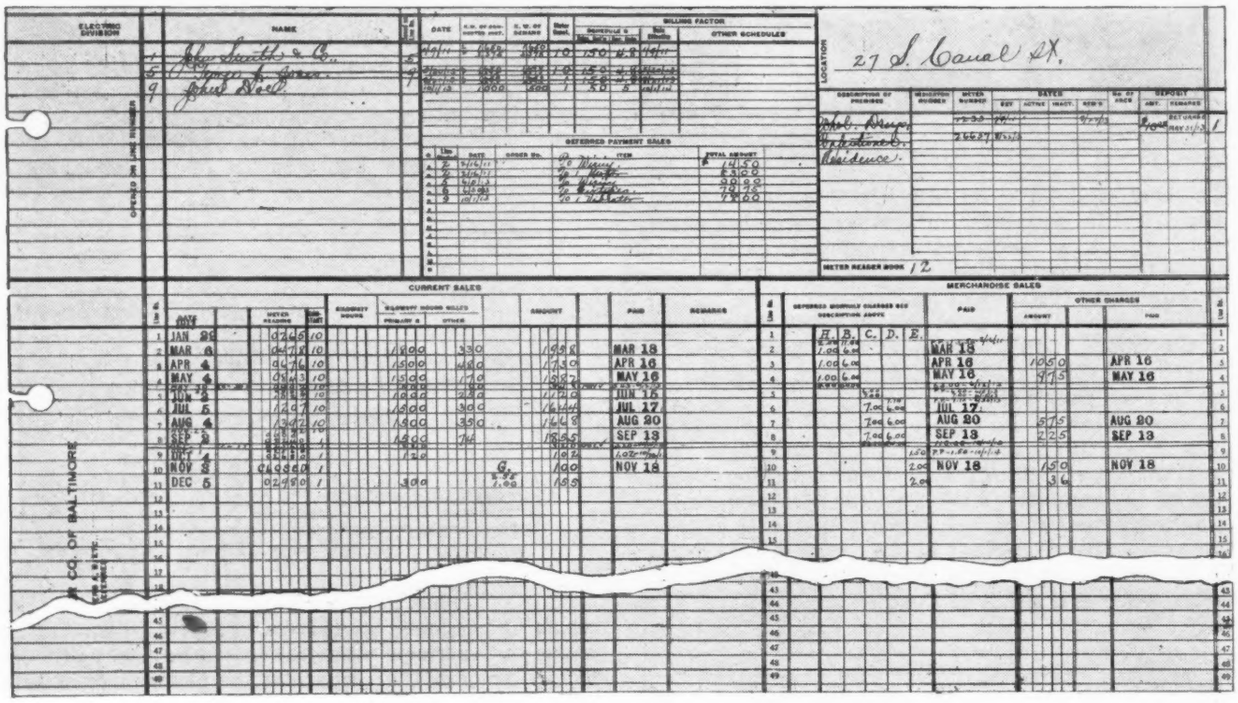
But one line is required each month to execute the complete billing, thus giving the ledger sheet a life of four years.

The reconciliation or balancing of consumers' accounts with general ledger in auditing department will be greatly facilitated by reason of separate debit and credit columns, making the proving of debits and credits very simple against supporting summaries and tabulations.

Horizontal billing lines were intentionally ruled alternately heavy to facilitate carrying unpaid items on current month's bills. This was considered desirable in view of the absence of a distinct "balance" column.

The company's commercial service schedule "B" provides for credit adjustment of minimum charge of $12 a year, and with a view of applying this credit monthly with a minimum of accounting entries the gross debit and credit amount of bill is posted in the blank column to the left of current sales amount, extending only the net in this latter column—thus the ledger gives all detail appearing on customers' bill but accounting is for net debit only.

The company's method of using the same ledger sheet for changes in contract relations at the same address created a demand that in some definite way the sheet should show where each customer's account began and ended, therefore opposite the name of the customer will be placed the number of the billing line upon which the predecessor's account terminated and successor's began. This will facilitate a general analysis of the account, for in many instances four or five changes have been made in contract relations at one address.

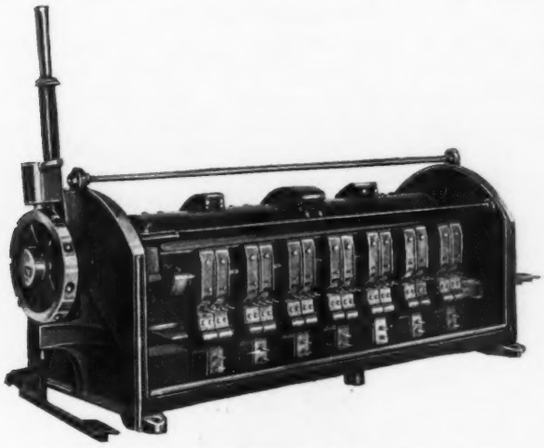


FAC-SIMILE OF ELECTRIC CUSTOMER'S LEDGER SHEET

NEW APPARATUS AND APPLIANCES

Large Drum Controller

What is said to be the largest drum controller ever built is illustrated herewith. It was made by the Industrial Controller Company, Milwaukee, Wis., for use in an electric steel plant. The controller is 8 ft. 5 in.

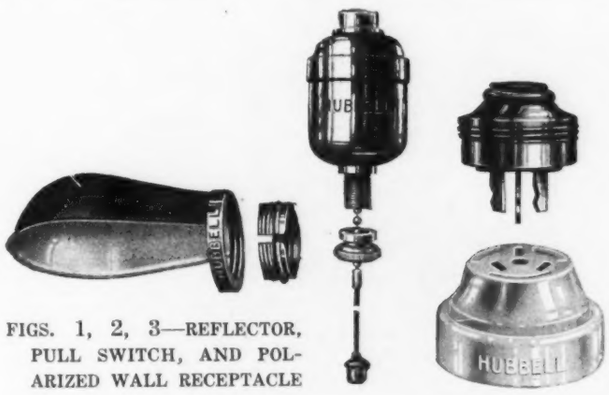


LARGE DRUM CONTROLLER FOR STEEL MILL

long and 3 ft. high and weighs approximately 5000 lb. A special ratchet arrangement was built for operating the cylinder as it is impossible for one man to turn the cylinder by means of the usual drum handle. The fingers of the drum are of cast copper and are provided with removable tips. Each of the twenty-eight fingers weighs 16 lb.

Incandescent-Lamp Reflector, Pull Switch and Wall Receptacle

In Fig. 1 is shown a small lamp reflector designed for tungsten lamps of small ratings. The reflector is made of tin or brass as desired. The pull switch illustrated in Fig. 2 is designed for use with indirect-lighting fixtures. It is a single-pole device and has a rating of 3 amp at 125 volts and 1 amp at 250 volts. The device is equipped with an ornamental lock bushing, and caps varying in diameter from ⅛ in. to ⅜ in. are used. The



FIGS. 1, 2, 3—REFLECTOR, PULL SWITCH, AND POLARIZED WALL RECEPTACLE

device is finished in polished brass, old brass or brush brass. In Fig. 3 is shown a polarized wall receptacle for three-wire work. The base is of porcelain and incloses brass terminals. The cap is also of porcelain and is equipped with a brass cover having a brush-brass finish. The devices described above are being placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn.

Electric Bacteriological Incubator

An electric bacteriological incubator recently developed is shown herewith and is, according to the manufacturers, superior to the gas-heated devices now generally used on account of the uniform temperature regulation obtained. When once adjusted to the desired temperature, it is claimed, it will operate for days at a time without any attention. The incubator is heated with electric resistance coils in the top of the device.

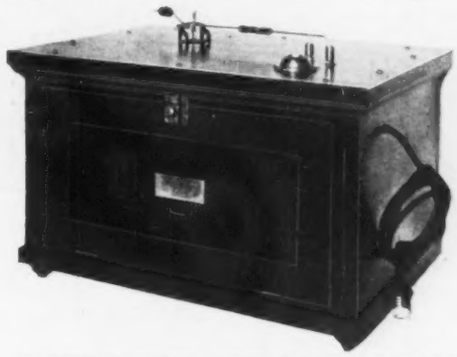


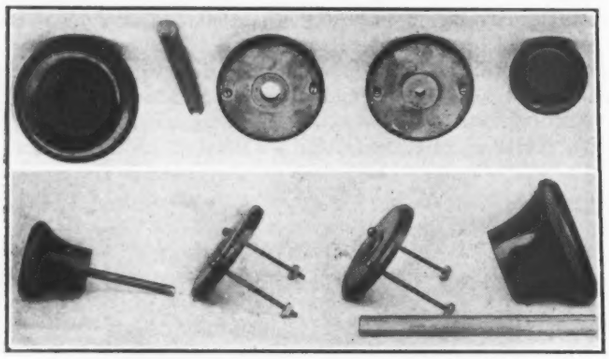
FIG. 1—BACTERIOLOGICAL INCUBATOR WITH DOORS CLOSED

A wafer thermostat inside the machine expands with rise in temperature and pushes a piston stem which raises and lowers a balanced lever arm carrying two electric contact points. These two contact points dip in mercury cups which are connected in series with one side of the circuit. When the temperature inside the incubator reaches the desired point, the contact point is lifted out of the mercury, thus opening the circuit. When the temperature falls just a small fraction of a degree, the contact points are lowered back in the mercury and the circuit is closed, thus bringing the machine back to the proper temperature. A variation of less than 0.1 deg. is said to cause the device to operate and to open or close the circuit. Temperature adjustment is obtained by means of a small screw. The incubator consists of a double-walled box having a 0.5-in. air space between the outer and inner walls. The box is finished in mahogany and is equipped with double doors, the inner door having a glass panel so that the contents of the machine may be readily inspected without opening the door. By touching a button a miniature lamp inside the incubator can be turned on. The maximum input into the machine is 50 watts, and the average input per hour is about 25 watts. The inside dimensions of the incubator are 8 in. by 16 in. by 10 in. The incubator is being made by the Electric Specialty Company, 154 Main Street, Salt Lake City, Utah.

FIG. 2—BACTERIOLOGICAL INCUBATOR WITH DOORS OPEN

Hand-Wheels and Dials

Inexpensive hand-wheels and dials for its rear-of-board type of field rheostats have been developed in two sizes by the Ward Leonard Electric Company, Bronxville, N. Y. The smaller devices are designed for the

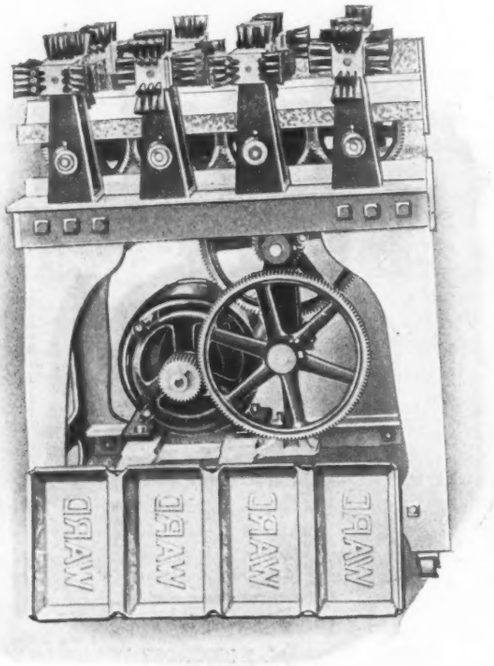


HAND-WHEELS AND DIALS FOR USE WITH RHEOSTATS

company's 6-in. enameled rheostat and the larger devices for the 8-in., 12-in. and 15-in. rheostats. The hand-wheels and dials are finished in polished black.

Electric Machine for Cleaning and Greasing Bread Pans

The machine shown in the accompanying illustration is designed for cleaning and greasing bread pans. The pans are cleaned by means of a set of stiff brushes, and then soft brushes are used to grease the pans. It is claimed that with ½ lb. of lard 2000 pans can be greased. The apparatus may be equipped with either a direct-connected or a belt-driven motor. The direct-



MOTOR-DRIVEN BREAD-PAN-CLEANING MACHINE

connected motors are provided with back gears operating the brushes at a speed of from 70 r.p.m. to 80 r.p.m. The motor is mounted on the frame of the machine below the brushes and is protected from crumbs and grease by a metal cover. The outfit is mounted on castors so that it can be moved about easily and connected to any lamp socket. The floor area required is 3 ft. by 5 ft. The machine may be equipped with either a 0.25-hp or a 0.5-hp motor. The machine is being made by Gottschalk & Company, Reedsville, Pa., and is operated by a motor made by the Robbins & Myers Company, Springfield, Ohio.

Fire-Alarm Box

A fire-alarm box of the break-glass type, developed to meet the requirements of recent fire-prevention laws, is shown in the accompanying illustration. The box is equipped with a mechanical movement which when started in operation opens and closes an alarm circuit the proper number of times to announce by a series of single strokes on alarm apparatus the number of box operated. After the glass is broken, it cannot be replaced until the box is rewound and set for another alarm. The mechanism is insulated from the case, and

BREAK-GLASS FIRE-ALARM BOX

contact is of the scraping self-cleaning type. The box is designed for use with surface conduit installations and is drilled and tapped for 0.5-in. conduit. The box is finished in red enamel and the raised letters are finished in white. The box has recently been developed by Edwards & Company, 140th Street and Exterior Street, New York.

Motor-Driven Peanut Roaster and Corn Popper

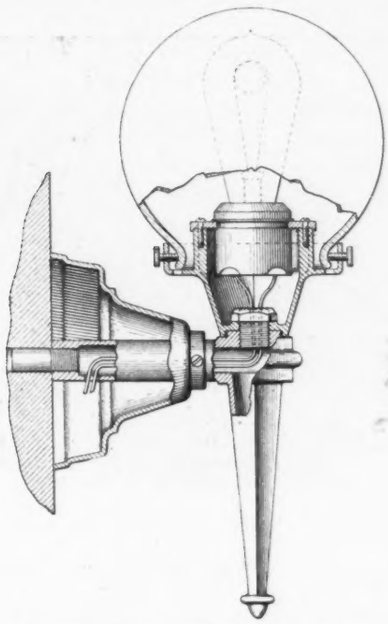
A peanut and popcorn car "de luxe," glittering in nickel and plate glass, illuminated with electric lamps at night, has been developed by the Kingery Manufac-

ELECTRIC PEANUT AND POPCORN CART

turing Company, Cincinnati, Ohio. A Westinghouse motor is used to operate the peanut roaster and the rotary corn popper, heat being obtained from a gas or gasoline burner. Energy is obtained through a plug at the vender's stand.

Outdoor Lighting Bracket

A section of a cast-metal weatherproof bracket for incandescent lamps is shown in the accompanying illustration. The bracket is designed to take a sign-receptacle socket and an outer globe for the lamp. The

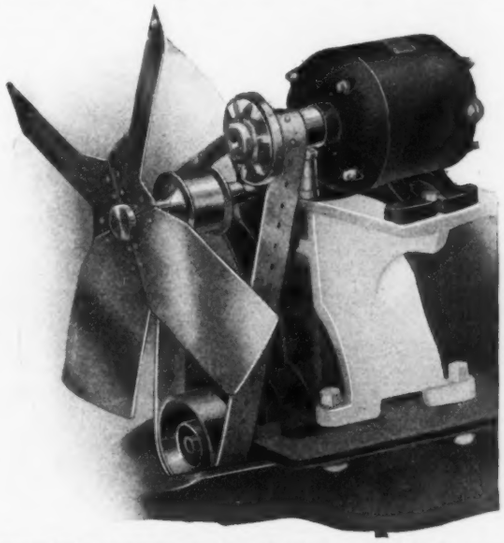


CAST-METAL OUTDOOR BRACKET

Herwig Art Shade & Lamp Company, 2141 North Halsted Street, Chicago, Ill., has recently developed this fixture.

Automobile Generator Equipped with Spur Pulley

The small automobile lighting generator shown in the accompanying illustration is equipped with a pulley with spurs which fit into holes in the belt. Three or four of these holes are always occupied by spurs and consequently no slippage results. The pulley on the

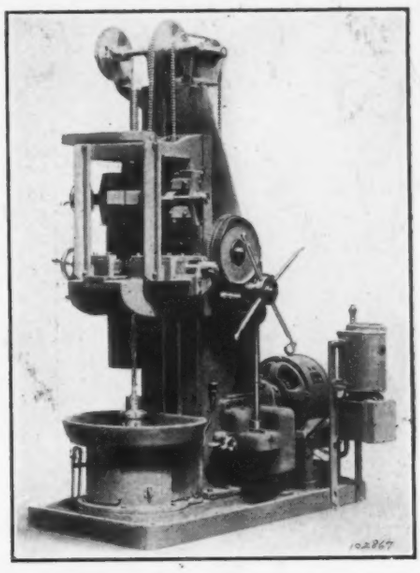


AUTOMOBILE LIGHTING GENERATOR WITH SPUR PULLEY

generator is really a sprocket and the belt is the equivalent of a leather chain. The "porcupine" drive, as it is called, has been designed for automobile lighting outfits developed by the Carleton Company, 170 Summer Street, Boston, Mass., for use on Ford cars.

An Inverted Drill

The drill shown in the illustration herewith operates from the bottom upward instead of downward as is the usual practice. The machine is designed for drilling ninety-point carbon billets, 20 in. long and 4 in. or 5 in. in diameter. In drilling the pieces in an inverted position the driving spindle, it is claimed, is rigidly held at

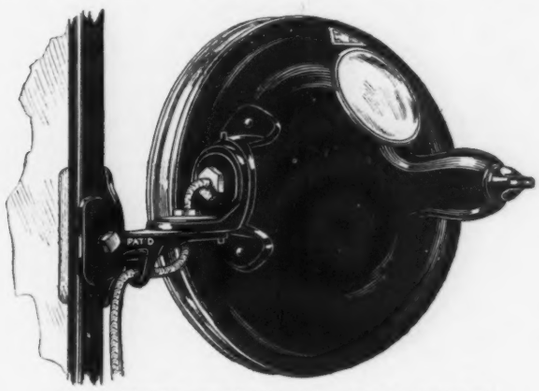


ELECTRIC DRILL OPERATING FROM BOTTOM UPWARD

the bottom of the machine and vibration is reduced to a minimum. The head of the machine is really a jig for holding the pieces, and two sets of jaws are provided to grip the upper and lower parts of the billet and insure centering. The machine described is being manufactured by the Foote-Burt Company, Cleveland, Ohio, and is driven by an 8.5-hp Westinghouse direct-current adjustable-speed motor, controlled by a Westinghouse drum controller.

Combined Mirror and Automobile Searchlamp

In the accompanying illustration is shown an automobile searchlamp equipped with a mirror so that in daytime the driver can be warned of vehicles approaching from the rear. The switch is in the handle of the lamp. The lamp is equipped with an adjustable bracket



AUTOMOBILE SEARCHLAMP WITH MIRROR

which automatically locks at any angle desired, and also with a detachable back reflector by means of which the bulbs can be removed or replaced without fingering or soiling the polished surface. The Wood Manufacturing Company, Fairfield, Conn., is making this device.

Alternating-Current Motor

In the accompanying illustration is shown a 5-hp, sixty-cycle, three-phase, 220-volt "Jenney" motor made by the American Rotary Valve Company, Chicago, Ill., which is especially adaptable for printing-press drive. Equally spaced tapped holes are provided in the outer ring of the frame so that the base, shown separate in the illustration, can be attached to the frame in any one of twelve different positions without affecting the relation of the rotating and stationary parts. With a frame of this type, special brackets for back gears can be attached to the frame either at the top or sides. Special supports may also be utilized for attaching the motor to the machine drive so that special frames are not required with the machines.

5-HP INDUCTION MOTOR

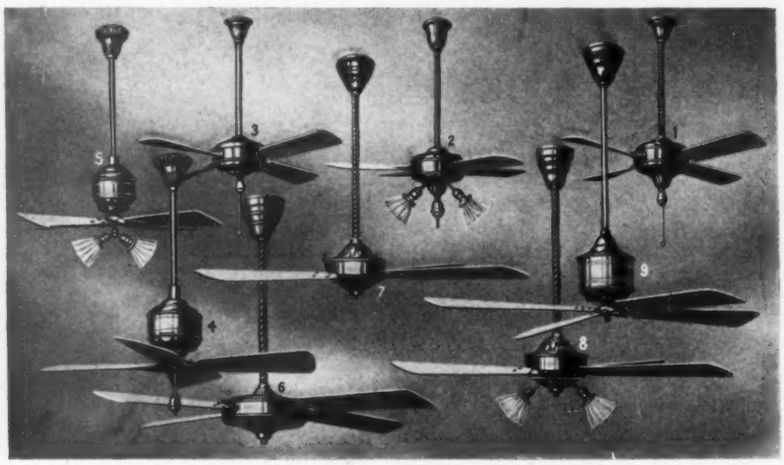
New Form of Screwed Conduit

A new form of screwed conduit has been introduced in Great Britain by the Perfecta Seamless Tube & Conduit Company, Ltd., Birmingham, England. In place of providing both ends of lengths of conduit with male threads for the purpose of joining lengths of conduits by means of nipples, only one end of each length of conduit is provided with a male thread. The other end of each length is bulged out and tapped with a tapered female thread. This permits two lengths of conduit to be joined without the use of a nipple. When it is necessary to use an odd length of pipe the short length is always cut off from the bulged end and the cut end of the piece to be used is tapped for the usual parallel male thread. A nipple is then employed to join the lengths. It is claimed that with the improved ends absolutely watertight joints are made because of the tapered construction of the female thread.

Electric Fans

Various types of oscillating and swivel-and-hinge desk-and-bracket fans and ceiling and column fans will be placed on the market for the coming season by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. A few changes have been inaugurated, notably in the direct-current ceiling fans, which have been made larger, the 56-in. and 58-in. types being substituted for the 54-in. and 57-in. models of former years. The increasing use of fans in the home, the manufacturers declare, has also made it advisable to include a separate attachment plug and 8 ft. of cord with each desk-and-bracket fan. Drawn metal is employed in making the frames and is also used for the motor base.

In the accompanying illustration are shown several types of ceiling fans. The new 56-in. direct-current fan is provided with a combination fiber and tool-steel bearing which is immersed in oil. For lubricating the motors of the 56-in. and 32-in. alternating-current ceiling fans and the motors of the 56-in. direct-current fans oil is poured into a hole at the top of the motor and runs into a reservoir around the bearings. The bearings are therefore immersed in oil. When the motor is in operation the oil is pumped upward along the shaft by means of a spiral groove on the shaft and flows back into the reservoir.



CEILING FANS

Fixture for High-Candle Power Incandescent Lamp

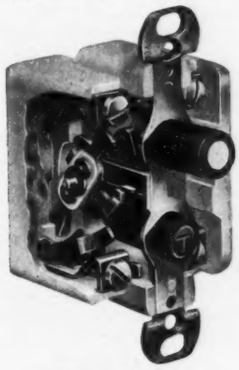
In the accompanying illustration is shown one of several fixtures called "maxolites" which have recently been developed by the Central Electric Company, Chicago, Ill., for large incandescent lamps. The unit illustrated is designed for lamps with ratings of 200 cp and 300 cp. The reflector is a one-piece ventilated, weatherproof stamped-steel porcelain-enameled device and is finished blue outside and white inside. It is 18 in. wide and 10.5 deep.

OUTDOOR FIXTURE FOR HIGH-EFFICIENCY INCANDESCENT LAMPS

A so-called type "R" fitting is used with the fixtures, and it consists of a malleable-iron reflector seat with a neck at the top, which is threaded both inside and outside, the inside thread taking the conduit and the outside thread a lock nut. The reflector is held between a lead washer on top and a cork washer beneath. A split porcelain socket is employed, the upper part being fastened to the reflector seat. A thin rubber gasket is placed between the two parts of the socket to make it waterproof.

Push Switch

A rugged push switch, shown herewith, has recently been placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Conn. The device is made from as few parts as possible, in order to lessen friction and concentrate the strength where it is most



PUSH SWITCH

needed. The design of the mechanism is shown in the illustration, and smooth and easy action is claimed for it. The device has been passed by the Underwriters and is called the "circle T" push switch.

Textile Motors

On account of the varying conditions of manufacture in textile mills, motors intended for this class of service must be designed to operate under sustained overload. Dust-proof bearings, elimination of parts which might be clogged with flying lint and freedom from fire hazard are also necessary. In some cases slow acceleration is required to prevent breakages, and with others very rapid acceleration to secure similar results.

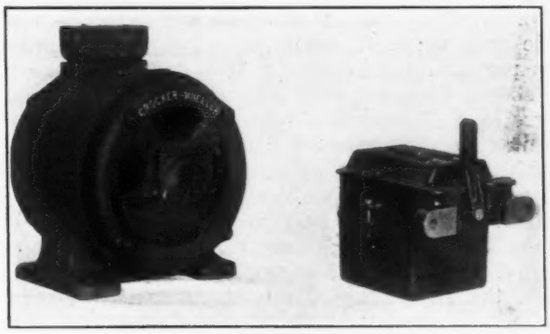


FIG. 1—INDUCTION MOTOR FOR TEXTILE MILLS

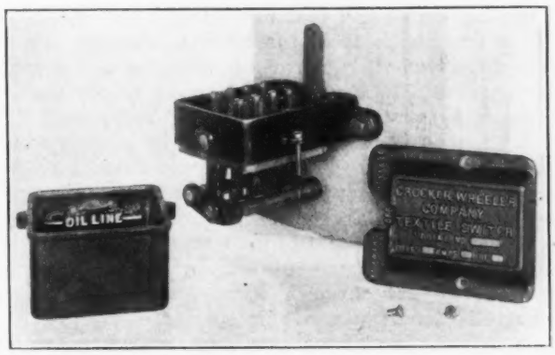


FIG. 2—OIL SWITCH WITH COVER AND TANK REMOVED

Polyphase squirrel-cage motors recently placed on the market by the Crocker-Wheeler Company, Ampere, N. J., have been developed to cover the above requirements. The machines are built with ratings of 0.5 hp to 2 hp, and they are designed to develop high or low torque according to the service for which they are employed. In Fig. 1 is shown one of these motors and also a switch designed particularly for textile service. The motor is equipped with large journal boxes and large oil wells, an essential feature for textile service. A standard box provided with knockouts is placed on top of the motor as shown. Large bearings are used throughout. The rotor is of solid construction, the end rings being riveted to the laminations. All bearings are of the oil-ring type. All contact making is done under oil.

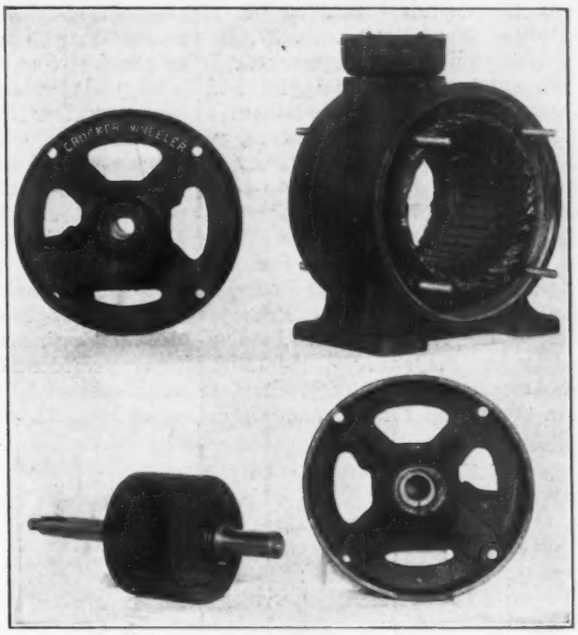


FIG. 3—MOTOR WITH PARTS DISASSEMBLED

Pressed-Steel Service and Cut-Out Boxes

One of the features of the pressed-steel box shown herewith is the depression provided for the ring-type handle for the cover, which when not in use can be placed so that it is flush with the surface of the cover. The box is electrically welded and the door overlaps the box on all four sides. Four 5/16-in. holes in the bottom 1 in. from each corner are provided for fastening the cabinet in place. Boxes similar to the above are made in a number of different standard sizes by the Electric Operations Company, Bush Terminal, Brooklyn, N. Y., and are provided with 7/8-in. knock-outs for 1/2-in. conduit pipes.

METAL CUT-OUT BOX

CURRENT NEWS SECTION

Inauguration of the Engineering Foundation

At the exercises held in the Engineering Societies Building, New York, Jan. 27, in connection with the inauguration of the Engineering Foundation, it was announced that the initial gift had been made by Mr. Ambrose Swasey, past-president of the American Society of Mechanical Engineers, who donated $200,000 for "the advancement of the engineering arts and sciences in all their branches to the greatest good of the engineering profession and for the benefit of mankind."

Addresses were made by Mr. Gano Dunn, president of the United Engineering Society; by Dr. Henry S. Pritchett, president of the Foundation for the Advancement of Teaching; by Dr. Robert W. Hunt, past-president of the American Institute of Mining Engineers, and by Dr. Alexander C. Humphreys, past-president of the American Society of Mechanical Engineers.

In arranging for the administration of his gift, the

AMBROSE SWASEY

interest upon which is to be devoted to the purposes indicated, Mr. Swasey insisted that his name be not associated therewith in order that equal credit may be bestowed upon all donors who will contribute to the general fund to be used as indicated. The administration of the fund will be intrusted to the Engineering Foundation Board, elected by the trustees of the United Engineering Society and composed of eleven members, nine from the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, and two members chosen at large.

The donor of the initial fund is widely known as a member of the firm of Warner & Swasey, prominent machine-tool builders and foremost builders of telescopes in the world. Among the instruments they have designed are the famous Lick, Yerkes and United States Naval Observatory telescopes, as well as the 72-in. reflecting telescopes for the Canadian government, now under construction. Mr. Swasey is also known for his practical efforts toward scientific education and the advancement of his profession. Mr. Swasey is a fellow of the Royal Astronomical Society and past-president of the Cleveland Engineering Society. In 1900 he received from the French government the decoration of the Legion of Honor for his achievements in the design and construction of astronomical instruments. On Jan. 26 a testimonial dinner to Mr. Swasey was given by the president and board of trustees of the United Engineering Society. A number of speeches were made by leading engineers representing the civil, mining, mechanical and electrical branches of the profession, thus helping to cement further the close relationship now existing and giving promise of hearty co-operation in future on all matters affecting the profession in general.

Mr. Tripp on Business Conditions

In an address before the New England Street Railway Club in Boston on Jan. 21 Mr. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, discussed general business conditions. He said in part:

"A most serious situation confronts us. The country finds its industries generally in an unparalleled state of prostration, and it is worth while to speculate a little over what, if anything, we can do to mitigate this paralyzing depression. It is quite probable that we should have had very great business stagnation or worse even if there had been no war, and the effect of the war itself has been a surprise.

"The prevailing feeling in England and France, when the war broke out, was that a terrible situation confronted Europe, but that great benefits would come to the United States; nevertheless, after six months, we find the situation just the reverse. So far as I can learn, the experience of the companies I represent is typical of present manufacturing conditions in the countries where we are situated.

"Our company in England is running at full capacity, while in this country our works are operating between 50 and 60 per cent of normal output. The English company is not working upon war orders but upon its usual character of goods. This, of course, is due to the fact that England has been able to keep the seas clear for her commerce and that her colonies and other countries, which had been in the habit of dealing to a considerable extent with Germany, have transferred their entire business to England. It seems to me that this will be a permanent condition; that is to say, if the Allies should win, England will derive greater permanent commercial benefit from the war than the United States will do. Our works in France are running full time, but to a very large extent on orders for the French war department. Our Italian works are running full time; and, judging from the very infrequent and vague news we can get through from Austria, our Vienna company is enjoying usual prosperity.

"Therefore, so far as our own interests are concerned, they are very much more prosperous in Europe than in the United States. It is true that there have been some war orders received in this country, but the effect has been a great deal more than offset by the great disturbance of foreign exchange and the difficulty of handling our large indebtedness to Europe.

"The war has also obscured the effect of the recent anti-trust legislation and tariff reduction, and will obscure the effect of the proposed bill for government ownership of a merchant marine, should such a bill pass Congress, which I hope it will not do. We are asked to believe that these laws remove all barriers and that it only remains for us to get busy and seize the markets of the world from England and Germany.

"Anything that helps our export trade is good and we are all trying to increase foreign commerce, but our prosperity still rests upon our home markets. There are 100,000,000 people in the United States, and in comparative consuming capacity they weigh a great deal heavier than their numbers; and the removal of any measure of encouragement and protection of home industries on the theory that the injury will be repaired by any increase in foreign trade that we are likely to retain permanently in competition with England and Germany is a colossal mistake.

"The recent reduction in the tariff had, before the war, shifted the balance of trade against us; that is to say, the new tariff went into effect Oct. 4, 1913, with the result that, after many years with the balance of trade being continuously in our favor, in April, 1914, it swung the other way and imports began to be greater than exports. In addition to depriving the government of revenue, which resulted in the income tax law, this would have had a very severe effect on our home industries, and upon the market for labor, even if there had been no war. It is true that the balance is now in our favor, owing to exports of raw materials needed by the countries now at war, but the period between April 1 and Aug. 1 of last year may have been a demonstration of the real effect of tariff reduction. It should be remembered that the export of raw material as distinguished from manufactured goods is a distinct disadvantage to labor.

Desirability of a Tariff Commission

"It is vital that this great market of ours should be in a fair degree protected against foreign competition even if we have to let export trade take care of itself, and to that end I believe your organization and we ought to co-operate in encouraging a popular demand for a tariff commisssion which can intelligently pass upon this complicated and delicate question. While this is being done, and it will take some time, say until 1916, home industry needs a stimulant; and, after all, the most important thing for us to do, and the most sensible way in which we can co-operate at this time, is to join hands in bringing about a better business state of mind.

"When we come to think of it, there have been plentiful crops to feed and clothe the people, the railroads are ready and anxious to transport them, the mills are waiting to fabricate them, and labor is waiting to do the work. Is there not something we can do to help set these agencies in motion/ It will help if we all agree that it is time to let up a little on conservatism and take some chances by beginning some of the work which is being held back. If there should be a general movement and everybody should make a cautious start, taking a little but not too much risk, the result would be surprising.

"The manufacturer might begin the manufacture of a reasonable reserve stock of standard goods, and you can all utilize these dull times to overhaul and repair your roadbed, plant and machinery and make small additions against future growth. I hope you will not think that these ideas are impracticable and mere idle theorizing; for, if there can be such a thing as co-operation in the business world which is worthy of name, this suggestion is the simplest form it can take."

Canada Voices Its Right to Forbid the Exportation of Electrical Energy

Holding that the interests of Canada are paramount, and that whenever the Canadians feel that they can use to advantage the energy now generated for export they can, and no doubt will, cancel the licenses permitting its export into the United States, the Privy Council of the Dominion of Canada has declared that a contract to export electrical energy from Canada to the United States may be revoked at any time.

As is well known, the Dominion government grants licenses yearly to certain electrical corporations of Canada near the border to export electricity into the United States. In the report of the committee of the Privy Council on this custom it is declared:

"The effect of these laws and the procedure is clear, and it must be abundantly apparent what the object of this government has been and is. Power or energy generated from streams in Canada has been, as it must be, regarded primarily as a natural resource of the country to be developed and utilized to the utmost possible extent for the benefit of the country; and it was recognized that, while it was consistent with that view to permit exportation so long as the demand in Canada for power should not be sufficient to absorb the whole production, yet it could be permitted only in such manner and on such terms as did not conflict with the ultimate necessity of securing and preserving this natural resource for the use of the people of Canada, if and when needed by them."

All of the large generating systems at the Niagara frontier line export a large part of the energy generated into New York State, and when the Canadian-American Power Company applied to the Public Service Commission, Second District, New York, about a year ago for the right to issue stock on a contract made with the Electrical Development Company of Ontario for a large block of electricity to be used in the United States there was a sharp difference of opinion between the commissioners as to whether the companies should be allowed to capitalize the contract.

In granting the right of the company to capitalize the contract Commissioner M. S. Decker, who wrote the majority opinion, said: "As to the nature of the contract, it must be held that by such a contract the purchasers of this power acquire a valuable right. . . . Rights acquired under an assignable contract of this character are salable for value. . . . There is nothing to indicate that these purchasers are standing in the light of mere brokers for the Electrical Development Company."

Commissioner Decker's discussion at the time on the yearly licenses from the Dominion government is also of interest now in view of the decision of the Privy Council. Mr. Decker wrote:

"The formality of securing a license yearly from the Dominion government is required by the Dominion law, but such license has been granted yearly to the great producing electrical corporations of Canada, and no reason appears for apprehension that any discrimination will be made against the Electrical Development Company or the Toronto Power Company, lessees. We have nothing before us but the suggestion that the Dominion of Canada may at some future time forbid this exportation. This commission must assume that international relations affecting so important a subject as the means of continuing great industries which have grown up in reliance upon the use of this imported power, and as well the interests of the Canadian producing companies, thus have become fixed and subject only to such changes as will protect the great commercial and industrial interests and rights

now served by this power brought from Canada. The time has long since passed when governments proceed ruthlessly from purely national rashness or anger to destroy the settled, accepted commercial relations and formal vested rights of business corporations. . . . Without going into details it seems sufficient to say that the prohibition of exportation from Canada of this present electric power which now comes into this country would paralyze business and industries of many kinds, and would deprive numerous localities of electricity for light."

Defeat of Muscle Shoals Project

Interest in water-power developments in Washington recently has centered in the defeat in the House of Representatives of an item in the rivers and harbors appropriation bill which provided a preliminary expense of $150,000 toward the $18,000,000 project to remove Muscle Shoals in the Tennessee River between Brown's Island and the Railroad Bridge below Florence, Ala.

Notwithstanding championship by Mr. Underwood of the project, which has been approved by the chief of engineers of the army, a fight on the item, led by Representative Lenroot, was successful, the vote to throw it out of the bill being 77 to 62. In passing the rivers and harbors appropriation bill at midnight on Jan. 19 the House was told by Mr. Lenroot that the item carrying $150,000 was merely an entering wedge for an eighteen-million-dollar water-power project under which the government would advance the capital for the construction of three dams to be leased by a water-power company.

N. E. L. A. Accounting Committees

The following committees for the proposed new accounting section of the National Electric Light Association have been appointed:

Committee on uniform system of accounts—Messrs. J. L. Bailey, chairman; R. H. Ballard, J. H. Gulick, L. M. Wallace, C. L. Campbell, E. J. Allegaert.

Library committee—Messrs. E. J. Allegaert, chairman, and C. E. Murray.

Convention committee—Messrs. F. J. Blanchard, chairman, and R. H. Ballard.

Question-box committee—Messrs. E. C. Scobell, chairman; R. W. Symes, C. E. Foster and H. R. Kern.

Cost-accounting committee—Messrs. J. H. Gulick, chairman; C. L. Campbell, E. J. Allegaert and R. W. Symes.

Annual Meeting of Wisconsin Contractors

The twelfth annual meeting of the Electrical Contractors' Association of Wisconsin was held at Milwaukee, Wis., Jan. 18, 19 and 20. The program covered a wide range of subjects, from bookkeeping systems on the one hand to wireless telegraphy on the other. Papers were presented by Messrs. H. P. Andrae, of Milwaukee, who defended the position of the electrical jobber; D. E. Roberts, of Racine, whose subject was "The Contractor in the Field"; G. W. Hill, representative of the National Electrical Contractors' Association, who described its bookkeeping system; G. B. Muldaur, who told of the work of the Society for Electrical Development; L. G. Morgan, of the National X-Ray Reflector Company; Earl A. Anderson, of the National Lamp Works of the General Electric Company, and C. L. Chaffee, a student of the School of Engineering of Milwaukee, who gave a demonstration of long-distance wireless control of local electrical circuits. During the closed sessions of the convention Messrs. Z. Netzhammer presented a paper entitled "Where to Put It and Where to Find It," and Mr. C. B. Kreider, of Chicago, presented a paper on "Estimating." The election of officers resulted as follows: President, Mr. L. W. Burch, Madison; vice-president, Mr. F. L. Natwick, Grand Rapids; secretary, Mr. Albert Petermann, Milwaukee; treasurer, Mr. George Knoerr, Milwaukee; director for two years, Mr. Paul F. Harloff, and director for three years, Mr. W. R. Johnson, Wausau.

Investment Bankers on Water-Power Development

The board of governors of the Investment Bankers' Association of America, at its meeting in New York on Jan. 22, passed a resolution declaring that "in any law intended to permit or encourage the development of water-power on the public lands of the United States a provision for the taking over of the property of any company developing such water-power at any value excluding value as a going concern or at any value other than the then fair value would tend to discourage such water-power development because of the confiscation of a large part of the value on which the integrity and marketability of securities on any such project must depend, and in its opinion would inevitably make it necessary to charge higher rates to the public for such service in order to cover amortization of the investment."

The Federal Trade Commission and the Tariff

Much of the interest in the Federal Trade Commission last week has centered around a speech made in the House by Representative Whitacre of Ohio in which he disagreed with President Wilson's Indianapolis statement that the commission under the Newlands act will have the powers, duties and responsibilities of a tariff commission. Mr. Whitacre is a Democrat and voted in favor of the Underwood-Simmons tariff law.

Mr. Whitacre has introduced a bill, H. R. 20,248, to add to Section 6 of the Newlands act, authorizing the Federal Trade Commission specifically to gather information for the ways and means committee of the House and the finance committee of the Senate on tariff matters. He is likely to have the support of all Republicans, notably Representative Mann, the minority leader, who has introduced a bill providing for the appointment of a tariff commission, and will also have the support of some Democrats, not a few of whom are dissatisfied with the way the present tariff law has worked out.

Mr. Whitacre's expressed idea is that there shall be a "scientific" revision of some schedules of the tariff, and that the Federal Trade Commission shall be instructed to make a "scientific" report.

A new name mentioned in Washington in connection with possible appointment to the Federal Trade Commission is that of Mr. Will H. Parry, of Seattle, Wash., a Progressive in politics. It is now being reported in Washington that Mr. Joseph E. Davies, Commissioner of Corporations, will most likely be chairman of the new commission. The chairmanship is an elective position. Southern candidates for membership on the commission were said to be Mr. Thomas S. Felder, former Attorney-General of Georgia; former Governor M. F. Ansel of South Carolina; former Governor O'Neil of Alabama, and Mr. J. E. Richardson, a former judge of the Supreme Court of Tennessee.

Messages of Governors on Public Utilities

In messages to the legislatures now beginning their sessions governors of states refer to public utility affairs as follows:

Governor Dunne of Illinois

"The beneficent effects of the operation of the utilities law are already apparent on every hand. Discriminations in rates and service have been eliminated, and it may now be said that strict rate uniformity prevails among all the utilities of the State. The question of rates has probably been most often brought to the attention of the commission; for while rates and service are fundamentally joined in almost every case, the majority of complaints coming to the commission thus far have found their expression in terms of rates.

"While the operations of the commission have been satisfactory throughout the entire State, including Chicago, and while there seems to be no sentiment at the present time in favor of local commissions to regulate intra-urban utilities down the State outside of Chicago, there is considerable sentiment in that great city in favor of a local ancillary commission, to take charge of and control the intra-urban municipal utilities of that city, and, I, therefore, favor the creation of such an ancillary commission for the city of Chicago to take charge of and control the intra-urban utilities of that city."

Governor Ferris of Michigan

"We now have a Railroad Commission to which is given the power to fix rates and regulate the practices of railroads, telephone and power companies. I would recommend the enlargement of the powers of this commission to cover all public utility corporations of the State. Furthermore, as there can be no intelligent fixing of charges without a knowledge of the real value of the properties, I would recommend that the commission be authorized to make physical valuation of all such properties as it may deem advisable, that the rates fixed may return reasonable dividends on actual cash investment."

San Francisco's New Exposition-Civic Auditorium

The Panama-Pacific International Exposition Memorial Auditorium, which has just been completed and dedicated, gives to San Francisco one of the best equipped buildings of its kind in the United States. A four-story structure, covering an area of 404 ft. by 265 ft., it occupies an entire block (Grove, Larkin, Hayes and Polk Streets) in the city's new Civic Center and is a feature of the architectural cluster of Civic Center buildings.

The building with its equipment cost $1,250,000, and the ground it occupies was provided by the city at a cost of $701,000. Following the close of the Exposition, at the end of 1915, the auditorium will be presented to the city of San Francisco as a permanent memorial to the Panama-Pacific International Exposition. It will then become the city's great public forum. During the Exposition year the building will be the scene of many of the 300 or more congresses, representing national and international associations of every character, that make up one of the most interesting portions of the Exposition program.

The auditorium compares favorably with Madison Square Garden in New York City and the Auditorium in Chicago. The interior forms a complete quadrangle with balconies on three sides. The seating capacity is 11,000. The main auditorium occupies the center section of the building, shown by the offset in the photograph, and this is flanked on each side by large banquet rooms on the ground floor and committee and exhibit rooms on the second and third floors. The building also contains a large number of offices and is in every way well adapted for handling the conventions. Four electric passenger elevators are provided.

The lighting of the main auditorium is by means of forty-eight 500-watt tungsten lamps, which are placed in the octagonal center portion of the roof. This lighting is supplemented by single-unit fixtures above the balcony. The space underneath the balcony is lighted with bowl-type fixtures. The lighting throughout the building is of the exposed type, and no indirect units are used. Semi-indirect lighting is used in all the small halls, reception rooms and committee rooms in the building.

FIG. 1—CIVIC AUDITORIUM IN SAN FRANCISCO

The Lighting Arrangements

The lighting scheme as laid out for the Civic Center Plaza, toward which the auditorium faces, will provide sufficient illumination to bring out all the architectural features of the building, and for that reason all decorative lighting was omitted from the exterior. The lighting scheme, which has proved highly successful, is due to Mr. W. W. Hanscom, consulting engineer of San Francisco.

The heating and ventilating plant is one of the largest in the United States and is motor-driven throughout. There are nineteen direct-current motors, aggregating 240 hp. The amount of steam required, with all of the equipment in use, will be about 1000 boiler-hp. The main supply fans for the auditorium, of which there are two, deliver air at the rate of 290,000 cu. ft. a minute. The exhaust fans in the attic remove an equal amount of air per minute.

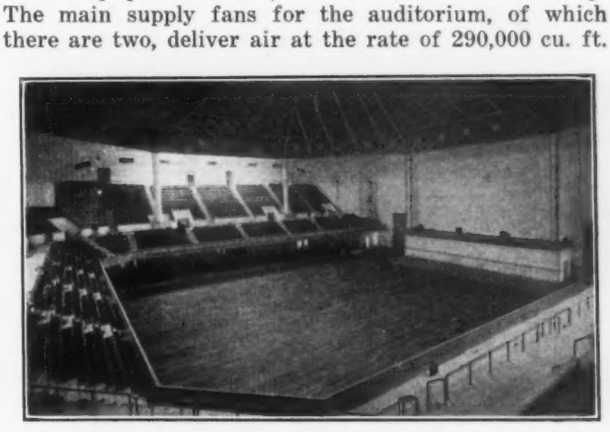


FIG. 2—MAIN ASSEMBLY HALL OF AUDITORIUM

The heating and ventilating plant was designed by Messrs. Hunter & Hudson, local engineers, and installed, with modifications, by the Division of Works of the Panama-Pacific International Exposition, Mr. G. L. Bayley being chief mechanical and electrical engineer.

The United Electric Light & Power Company Leases New Showroom

The United Electric Light & Power Company, New York City, has entered into a term lease for a large store and basement, with office facilities on the second floor, in the new building in course of erection at the northeast corner of 146th Street and Broadway, and on or about June 1 will remove its up-town branch office and salesroom from the present location at 143d Street and Hamilton Place to the new quarters.

All of the electrical development on Manhattan Island north of 135th Street is from the mains of the United company. The growth in the business and the company's desire to establish better and more adequate facilities for the convenience of its customers led to the opening of the new office. The premises will be handsomely fitted up and equipped as the "United Electric Shop," and here the company's policy of merchandising electrical appliances of all kinds will be continued on a broader scale.

The past year has noted an increase of over 100 per cent in the sales of energy-consuming devices, the company believing in carrying on this business under strictly mercantile conditions in co-operation with electrical contractors and supply dealers within this territory.

The new "Electric Shop" will carry a full line of supplies properly displayed. The showroom will be open to the public in the evenings until 10:30. Adequate facilities for the application of service, payment of bills, making of complaints, renewal of lamps and the carrying on of all the ordinary business of a central-station supply company will be arranged for at the new location.

The company has in mind the establishment of an additional, but somewhat smaller, branch office at a later date. This additional office will be established perhaps 2½ miles to 3 miles further north for the accommodation of the company's customers, particularly those in the extreme northerly Washington Heights section, which is so rapidly building up.

Special Tours Arranged for N. E. L. A. Convention

Mr. George W. Elliott, master of transportation of the National Electric Light Association, has announced four circular tours to the convention of the association to be held in San Francisco, June 7 to 11. These trips will be arranged on the "all-expense plan," similarly to those arranged for the Seattle convention of the association in 1912, and the following have been tentatively planned:

Tour A—Red Special.—Leaving New York (Grand Central Terminal) about May 24, stopping for passengers at Albany (to receive Boston and New England passengers), Utica, Syracuse, Rochester, Buffalo and Cleveland; thence to Chicago, and from there to Keokuk to visit the hydroelectric plant of the Mississippi River Power Company; from there to Kansas City and then over the Santa Fé Railroad, stopping to visit the Indian Museum at Albuquerque, N. M.; next a day's stop at the Grand Canyon of Arizona; from there to Riverside, Cal., for a few hours, and thence to San Diego, Cal., for a halt of two days to visit the Panama-California Exposition and to rest at Coronado Beach. The special will then proceed to Los Angeles and Pasadena. The latter beautiful spot will be the headquarters for two days, and the many beautiful points of interest in and around these two cities will be visited during the stay. The tour will then be continued up from Pasadena to Yosemite National Park for a two-day visit. The hydroelectric plant known as the Big Creek development of the Pacific Light & Power Corporation, of Los Angeles, is situated at Cascada, and for those desiring to inspect this immense piece of engineering it is necessary to change at Fresno on this route and journey to El Prado (18 miles), and from El Prado to Cascada (56 miles); time consumed, seven and one-half hours going up this distance. Those making this trip will either miss seeing Yosemite Valley or leave Los Angeles ahead of the special train. After the visit to Yosemite the special moves up to San Francisco, arriving on the morning of June 5.

After the stay of one week in San Francisco, the special will travel over the Shasta Route to Portland and Seattle. From Seattle the party will go by steamer to Vancouver, making a short stay at Victoria, and from Vancouver the party will return over the wonderful scenic route of the Canadian Rockies to Chicago and back to New York. Time, including stay at San Francisco, thirty days.

Tour B—Green Special.—Will start from Chicago May 25 and follow the same route as the "Red Special" to San Francisco. The two train contingents will be together at all the important stops and will be like one party until San Francisco is reached. This train will leave San Francisco June 13 and will return by a different route from that of Tour A ("Red Special"). This tour will make its first stop at Lake Tahoe, and will then include the great hydroelectric system of the Pacific Gas & Electric Company at Lake Spaulding. The party will be conveyed there by automobile, and from Lake Spaulding will go over the famous scenic boulevard to Lake Tahoe. The party will then journey to Yellowstone National Park, entering at the Yellowstone gateway June 16 for a four days' trip through this reservation. After leaving Yellowstone, stops will be made, returning, at Salt Lake City, Glenwood Springs, and then through the Royal Gorge to Colorado Springs, Denver, and back to Chicago. Time, including stay at San Francisco, thirty days.

Tour C—Blue Special.—This train will make an especially fast run for the convenience of those who cannot participate in the earlier tours. It will leave Chicago June 4 and reach San Francisco on the morning of June 7. Passengers from New York will leave on the evening of June 3. This will be a going trip only, but those using this train desiring to join any of the circular tours returning may do so by specifying the returning route when arranging for transportation westward, provided sufficient notice is given in order to insure accommodations on the returning tour.

Tour D—Pink Special.—This train will leave New York (Pennsylvania Terminal) June 2 and will stop to receive passengers at Newark, Philadelphia, Harrisburg (for Baltimore and Washington), Pittsburgh, Columbus (Cincinnati connection), Indianapolis, and St. Louis and Kansas City; thence to Denver, Colorado Springs and through the Royal Gorge to Salt Lake City. The first "stay-over" will be at Lake Tahoe, Cal., to visit that beautiful spot and also the hydroelectric system of the Pacific Gas & Electric Company at Lake Spaulding. The entire party will be conveyed to Lake Spaulding over the beautiful scenic boulevard by automobile, returning to the train and reaching San Francisco early on the morning of June 7. This train will leave San Francisco on Saturday evening, June 12, and proceed up over the Shasta Route to Portland, thence to Spokane, and from there to Yellowstone National Park, entering at the Gardner gateway for a complete tour of the park, and returning out through the Gardner entrance, back to the Eastern destinations. Time, including stay in San Francisco, twenty-three days. Complete printed itineraries and total cost of tours will be ready Feb. 15.

Technical-School Instruction for Detroit Edison Employees

More than 250 employees of the Edison Electric Illuminating Company of Detroit are taking advantage of the company's offer to let them attend afternoon courses one day a week at the Cass Technical High School on the company's time. Special courses have been arranged which will be of value to employees in their work for the company. Candidates for this special instruction are named by the foremen and heads of departments, and every effort is made to encourage the men in their studies. Mr. S. C. Mumford, controller of the company, is a member of the Detroit school board and has taken a leading part in arranging the special curriculum, which includes courses in physics, chemistry, general science, accounting, etc. From the accounting department alone sixty employees are attending the once-a-week afternoon courses. At an electrically cooked dinner held at the Delray station of the company on Jan. 19 the high-school faculty and officials of the company conferred together on future plans for the employees' courses.

Idaho Commission Reverses Itself and Permits Competition

Reversing the decision of Nov. 7, 1914, the Public Utilities Commission of Idaho has granted the Idaho Power & Light Company a certificate of convenience and necessity in the Twin Falls section in competition with the Great Shoshone & Twin Falls Power Company. The first decision, which was construed as being the policy of the commission at that time, was written by Mr. D. W. Standrod and concurred in by Mr. John A. Bromquist, president of the commission. The present decision is written by Mr. A. P. Ramstedt and is concurred in by Mr. John W. Graham, who succeeded Mr. Standrod. Mr. Ramstedt did not participate in the first hearing, so that the decision is not a reversal of his opinion but is rather a change in policy as a result of the resignation of one member and the retirement of another. In explaining the decision the commission says:

"We do not wish to be understood as holding, or intending to hold, that the door of competition shall be thrown wide open in this State; but, unless it is shown that the utility desiring to enter a competitive field can give such service as will be a positive and material advantage to the public, it will not be allowed to enter a field already occupied, provided always that the existing utility is furnishing the public in its territory with adequate service with reasonable rates at the time of the threatened competition. Each case must be decided on its own particular merits."

Public sentiment in Idaho has been somewhat adverse to the denial by the commission of the necessity for competition in certain parts of the State where new companies have sought to enter the field occupied by existing properties. This sentiment has been reflected in the recent decision of the commission setting aside its former ruling denying the Idaho Power & Light Company the right to enter the Twin Falls district. It is indicated in a bill introduced in the Legislature on Jan. 5, the purpose of which is to repeal Section 48 of the Public Utilities Commission act, which makes it necessary for public utilities to secure certificates of convenience and necessity before entering any competitive field. This bill was introduced by Senator Thomas. In speaking of it he said:

"I believe that the right to destroy competition in any field should be eliminated. Competition is absolutely necessary in a great many cases. If men wish to take a chance and enter any chosen field in competition with other companies, I believe that no restriction should be put upon them. If, later on, one of the companies should eliminate the other as a competitor, I believe the commission should then have the right to regulate the prices of the winning company and not let exorbitant prices be levied."

Rate Agreement in Detroit

A new rate agreement has been made between the city of Detroit, Mich., and the Edison Illuminating Company. A reduction is made to 16,182 customers, including stores, small factories, hotels, churches and business houses, of 2 cents per kw-hr. in the lighting rate, or from 12 cents to 10 cents. It is to go into effect on July 1, when the present contract expires. The total reduction in the rates charged to the class of customers affected is estimated at $155,000.

No reduction is granted to residences, but the company intends to replace all carbon lights with 40-watt tungsten lamps. A total of 1,400,000 lamps will be supplied. For newly wired residences the company will furnish twenty tungsten lamps without charge, with the understanding that they are to be renewed when worn out. There are 73,626 residence customers in Detroit, on which basis Mr. Alex Dow, president of the company, says the offer of free tungsten lamps is equivalent to a bonus of $5 to each customer.

Aldermen Seek Local Control of Milwaukee Utilities

By a vote of twenty-five to eleven, the Common Council of the city of Milwaukee on Jan. 18 approved a bill to be presented to the State Legislature asking that the Wisconsin Railroad Commission be relieved of all jurisdiction over the public utilities in Milwaukee, and that the control of these utilities be placed within the jurisdiction of the Council. Debate on the bill revealed the fact that most of those aldermen who voted against the measure did not do so because they favored continuing the city utilities under the jurisdiction of the present commission but because they believed that a separate commission should be created to handle Milwaukee's utilities exclusively.

Plan for Publication of Commission Decisions

The utilities publication committee of New York has sent to public utility companies in the United States an announcement in regard to the scope and character of the plan for publication of "Public Utilities Reports Annotated." This plan was described in the issue of Dec. 5, 1914. The reports are to be published by the Lawyers' Co-operative Publishing Company of Rochester, N. Y., beginning as of Jan. 1, 1915. The enterprise is indorsed by the National Electric Light Association, the American Electric Railway Association and the American Gas Institute.

The committee says that the amount of material issued by the public service commissions in the country is so voluminous and a large part of it is necessarily of so temporary a character as to make publication in its entirety commercially impracticable. All material of general interest and permanent value, however, will be contained in the reports. The committee adds: "In order that such a set of reports may be a success it is obvious that the public service companies in the coun-

try must very largely subscribe therefor. In order to insure the success of the undertaking assurances have been given the publishers of substantial support from the public service corporations."

In order that these assurances may be carried out, a committee has been formed, of which Mr. E. W. Burdett, counsel of the N. E. L. A., is chairman. The circular is sent in behalf of the committee, the other members of which are as follows: Messrs. Randal Morgan, United Gas Improvement Company; J. W. Lieb, Jr., New York Edison Company; Anton G. Hodenpyl, Hodenpyl, Hardy & Company; Owen D. Young, counsel General Electric Company; O. B. Willcox of William P. Bonbright & Company, New York; Bernard Flexner, counsel Middle West Utilities Company; Charles F. Mathewson, counsel Consolidated Gas Company of New York; L. D. H. Gilmour, counsel Public Service Corporation of New Jersey, and Z. K. Graham, secretary.

Demand Principle in Gas Rate-Making

Mr. G. H. Cook, Kenosha manager of the Wisconsin Gas & Electric Company, presented a paper before a joint meeting of the Wisconsin Electrical Association and Wisconsin Gas Association at Milwaukee on Jan. 20 to 22 on "Commercial Aspects of the Application of the Demand Principle to Rates for Gas Service." He showed that in the five-year period ended June 30, 1914, operating revenues of gas utilities, as reported to the Railroad Commission of Wisconsin, increased from $4,009,205 to $5,002,909, or a little less than 25 per cent. During the same period the combined electric utilities increased in operating revenues from $4,443,930 to $8,013,844, or a little more than 80 per cent.

Mr. Cook spoke of the importance of a revision in the principle of rate-making in order to promote the acquisition of business and consequent increase in the popularity of gas service. He laid stress upon the inclusion of 5 per cent of the output expenses of gas plants in the computation of demand costs. He also suggested that the demand on a gas service be obtained over a period of approximately five minutes by observation of the meter test dial rather than over a period of fifteen minutes' observation of the watt-hour-meter test dial in the electric utility. The decrease in the time of observation appears to be justifiable because gas service does not lend itself to momentary and intermittent service as does electric service. These points are considered by Mr. Cook as the vital elements in the preparation of a demand rate applicable to any location.

Urge Engineer for Idaho Commission

A committee of Spokane (Wash.) engineers, members of the American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers and American Institute of Mining Engineers, has written to Governor Alexander of Idaho urging the appointment of an engineer as a member of the Public Service Commission belonging to that State.

The letter expressed the belief "that there is a well-founded tendency of late among State executives and legislative bodies in the appointment of members of utility and other regulative commissions to recognize that engineers are well fitted for such positions. Their training, education and experience render them more peculiarly qualified to deal with the large economic, industrial and development questions incident to state government than any other body of trained men. As a consequence their services are requisitioned more and more for the betterment of efficiency, expedition and service.

"We know that there are in Idaho many accomplished engineers. We therefore desire to call your attention to the preceding facts and to suggest respectfully that when you fill the present vacancy in the Public Service Commission of Idaho you consider favorably the appointment of one of your engineers."

Salem (Mass.) Central Station Gets Large Textile-Mill Contract

The Salem (Mass.) Electric Lighting Company, one of the Tenney properties, has contracted to supply electrical energy for a term of years to the Naumkeag Steam Cotton Company, the largest industrial concern in the city. In the fire of June 25, 1914, the Naumkeag company plant, including a private steam generating station of about 6000-hp rating, was destroyed. Since the fire the Salem company has been supplying part of the energy for motor service in the temporary manufacturing plant which was erected. The Naumkeag company is erecting a four-million-dollar mill of the most modern character, in which individual-motor drive will be employed on a scale requiring delivery of between 12,000,000 kw-hr. and 13,000,000 kw-hr. per year, based on 2800 hours' operation, an average load of about 5000 hp and a maximum load of about 7000 hp.

It is probable that there will be about 3000 motors in the weave shed alone, the usual size being ¾ hp, for individual driving of looms. The four-frame motor drive will probably be used on the spinning frames. All the motors are to be of the three-phase, sixty-cycle induction type, wound for 550 volts and 220 volts. In general, the motors in the weave shed are to be of the 220-volt type, others being wound for 550 volts. To meet the requirements of the mills, the Salem company will enlarge its generating plant from about 5000 kw to a total rating of 15,000 kw, probably installing two new turbo units with necessary boilers and switchboard equipment. This will make the central station the second largest taxpayer in the city. The expansion of plant illustrates the benefits of centralized management, as the Tenney interests point out the difficulty a single company under local management and financing would have encountered in carrying such a proposition through to a successful issue. The contract has no off-peak or other special features limiting demand, but calls for the delivery of the full amount of energy covered by Jan. 1, 1916.

This is probably the first instance in New England, if not anywhere, in which so large a cotton mill will be operated exclusively by energy generated in a steam-driven central station. The Naumkeag company made an exhaustive investigation of the possibilities of central-station service for textile-mill operation before reaching an agreement, and the management in reaching a decision gave much weight to the following points of advantage: Independence of power problems requiring executive consideration; flexibility of energy supply with respect to future conditions of production; release of large investment in generating plant equipment, building and land for profitable use in textile production; removal of evils of mechanical drive and assurance of realizing higher efficiency in individual operation of machines by direct-connected motors; reliability of central-station service from a plant which passed practically unscathed through the conflagration, and a motor-service rate close to the most efficient figures realized in textile-mill service.

Miscellaneous News Notes

Union Gas & Electric Company's Employees Will Affiliate with N. E. L. A.—At a meeting of 100 employees of the Union Gas & Electric Company, Cincinnati, Ohio, and the Union Light, Heat & Power Company of Covington, Ky., last week, plans were made to form an organization to affiliate with the National Electric Light Association. President W. W. Freeman told the men that, in order to encourage them in gaining information, the companies will pay half their initiation fee in the association.

Evening Classes in Applied Electricity at Lehigh University.—The electrical engineering department of Lehigh University has organized a ten weeks' evening class in applied electricity, meeting twice a week in the Physics Building on the campus at South Bethlehem, Pa. It is the intention to follow this general course by others in the specialized branches of electricity. Mr. S. R. Schealer, associate professor of electrical engineering at Lehigh University, is in charge, and many employees of the Lehigh Valley Light & Power Company and of the Bethlehem Steel Company's electrical department are enrolled.

Conners Creek Plant, Detroit, Nearing Completion.—By March 1 it is expected that the first 20,000-kw steam-turbine unit in the new Conners Creek plant of the Edison Electric Illuminating Company, Detroit, will be ready for operation. A second 20,000-kw unit is also being installed and will be ready for service shortly after the first. The station has been laid out in units, and each great turbine is served by a pair of nominal 2300-hp boilers like those at the company's Delray plant. The turbine units generate energy at 4600 volts, but this pressure is stepped up to 23,000 volts for transmission to the substations of the Edison Illuminating and Peninsular Electric companies. Tie lines will connect the new plant with the Delray station.

Middle West Utilities Salesmen Discuss Appliance Sales Methods.—Methods of encouraging the sale and use of electrical appliances in the properties operated by the Middle West Utilities Company were discussed at a meeting of commercial representatives of the various local properties held at the Chicago Beach Hotel, Chicago, Friday, Jan. 22. Twenty-six attended the all-day session and took part in the general round-table discussion. Mr. John F. Gilchrist, vice-president of the Middle West Utilities Company, and Mr. Mike S. Hart, general manager of the company's commercial department, spoke on the aims of the conference. The Middle West company's various properties in Maine, Vermont, New York, Virginia, Indiana, Illinois, Kentucky, Missouri and Oklahoma were represented at the meeting.

Electrical Bills Before Massachusetts Legislature.—Among the electrical matters being considered at the present session of the Massachusetts Legislature are bills to abolish the Gas and Electric Light Commission and to transfer its power and duties to the Public Service Commission; to prohibit the sale of electricity by any public service corporation at less than 5 per cent above the cost of production and distribution, and requiring that the maximum price shall not exceed 25 per cent in excess of the cost of production and distribution; ordaining that the minimum charge shall be abolished by both gas and electric companies and that municipal lighting plants may be established by a majority instead of by a two-thirds vote, as provided in the existing law defining the conditions under which municipal ownership may be adopted.

What the Society for Electrical Development Has Done.—The report of the Society for Electrical Development, just issued, illustrates by means of appropriate engravings the work the society has done. Among the services which have been performed in the last eight months have been the circulation of a number of motion-picture films, stimulating electrical business in general, publication of articles on various electrical subjects in trade journals, preparation of advertising copy for member companies, organization of local development societies in every city having 100,000 population or more, collection and dissemination of correct information on technical and non-technical electrical subjects, ordinances, etc., and furnishing information on how to decorate display windows and secure new business. The last part of the report outlines a proposed campaign of education and profit.

Chamber of Commerce Meeting.—The preliminary program for the third annual meeting of the Chamber of Commerce of the United States, to be held in Washington, D. C., on Feb. 3 to 5, shows that a number of government officials will participate. Among the speakers and subjects are: Secretary of State Bryan on "American Investments Abroad"; Mr. Samuel McRoberts, vice-president National City Bank of New York, and others on "The Federal Reserve Act in Relation to Trade Expansion"; Mr. A. W. Douglas, chairman of standing committee on statistics and standards, on "The 1914 Census of Manufactures and the Present Status of Government Export and Import Statistics"; President Woodrow Wilson; Secretary of the Treasury McAdoo and Senator Burton on "Development of the Merchant Marine of the United States"; Mr. William H. Douglas, chairman special committee on merchant marine; Commissioner of Corporations Joseph E. Davies, on "The Federal Trade Commission"; Mr. Paul T. Cherington, chairman special committee on maintenance of resale prices, Mr. Harry A. Wheeler, of Chicago, and others on "Successful Methods of Commercial Organizations"; Dr. E. E. Pratt, chief of the Bureau of Foreign and Domestic Commerce, on "Recent Work of the Bureau of Foreign and Domestic Commerce"; Mr. E. A. Filene on "Trade Expansion and the European War"; Mr. R. G. Rhett, chairman special committee on trust legislation, on "Should Business Be Free to Enter Into Combination for the Development of Foreign Commerce?" Other subjects to be discussed are "Development of Foreign Commerce" and "How May We Secure Materials Needed in American Manufacture for Which We Are Now Dependent on Foreign Countries?" Secretary of Commerce Redfield and Governor Hamlin of the Federal Reserve Board are to speak at the banquet on Feb. 4.

Associations and Societies

Detroit Jovians.—"The Edison System" was the topic of a talk by Mr. J. W. Bishop, superintendent of substations of the Edison Electric Illuminating Company of Detroit, at a luncheon meeting of Detroit Jovians held Jan. 23 at the Detroit Chamber of Commerce.

Electrical Section of Western Society of Engineers.—At a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, Jan. 25, the annual election of the executive committee resulted as follows: Messrs. H. M. Wheeler, of the Chicago Railways Company; C. A. Keller, of the Commonwealth Edison Company; F. J. Postel, consulting engineer; G. T. Seely, Chicago Elevated Railways, and E. W. Allen, of the General Electric Company.

Annual Meeting of New York Contractors.—The New York State Electrical Contractors' Association held its annual meeting in Albany, N. Y., Jan. 19, and elected officers as follows: President, Mr. L. A. Wood, New York; secretary, Mr. George Russell, New York; treasurer, Mr. James Burns, Schenectady; members of the national board of directors, Messrs. James Strong, New York, James Hilton, Syracuse, and Rudolph Schmidt, Rochester. Mr. George Weiderman, Brooklyn, and Prof. Henry Neuberger, of Columbia University, read papers.

Baltimore Consolidated Section, N. E. L. A.—At the Jan. 20 meeting of the Consolidated Gas, Electric Light & Power Company's section of the National Electric Light Associationtion Mr. Washington Devereux, chief of the Board of Fire Underwriters of Philadelphia, spoke on "Impressions of Thirty-five Years in the Electrical Industry and a Forecast of Its Future." After the lecture a gold prize was awarded to the winners of a vocal quartet contest. Entertainment during the meeting included mandolin and guitar music, motion pictures and singing.

Annual Banquet of Lynn Section, A. I. E. E.—Over 160 members and guests of the Lynn (Mass.) section of the A. I. E. E. assembled at the American House, Boston, on Jan. 23 for the fourth annual banquet of the branch, which now has 540 members. The table decorations, which were especially effective, were arranged by the arc-lamp engineering department of the Lynn Works, General Electric

Company At the head table were Chairman William H. Pratt of the section; Mr. Walter C. Fish, toastmaster; Prof. Albert Bushnell Hart, of Harvard University; President Paul M. Lincoln of the Institute; Mr. H. A. Hornor, chairman of the sections committee, A. I. E. E.; Prof. Comfort A. Adams, of Harvard University, and Prof. Elihu Thomson, Lynn, Mass.

Michigan Electrical Association Membership Campaign.—A membership campaign is on in earnest to swell the enrolment of the Michigan Electrical Association, which is a State section of the National Electric Light Association. The help of traveling members of the Jovian Order has been enlisted to secure new members, and to the man obtaining the greatest number of such members for the association there will be awarded a gold watch valued at $50. The second prize is a silver watch. According to the secretary, Mr. Herbert Silvester, Edison Electric Illuminating Company, Detroit, Mich., the association expects this year to hold another convention on board ship, probably making a cruise on Lake Michigan in June.

American Wood Preservers' Association.—At the eleventh annual convention of the American Wood Preservers' Association held at the Congress Hotel, Chicago, Jan. 19, 20 and 21, a number of papers were presented on the treatment of ties, paving blocks and structural timber, although practically no discussion was accorded to poles. Officers for 1915 were elected as follows: President, Mr. J. H. Watermann, superintendent of timber preservation, Chicago, Burlington & Quincy Railroad; vice-presidents, Messrs. H. S. Loud, United States Wood Preserving Company, New York; Lowry Smith, Northern Pacific Railroad, Brainerd, Minn., and F. D. Beal, St. Helen's Crossing Company, Portland, Ore. Mr. F. J. Angier, Baltimore & Ohio Railroad, Baltimore, Md., was re-elected secretary-treasurer. The next convention of the American Wood Preservers' Association is to be held in Chicago.

Annual Meeting of St. Louis League of Electrical Interests.—At the annual meeting of the St. Louis League of Electrical Interests, St. Louis, Mo., Jan. 12, officers were elected as follows: President, Mr. F. D. Beardsley, sales manager Union Electric Light & Power Company; vice-president, Mr. F. Johnson, Wagner Electric Manufacturing Company; secretary, Mr. F. D. Phillips, Wesco Supply Company; directors, Messrs. E. C. Bennett, A. C. Einstein and F. E. Brinner. Addresses were made by Messrs. A. C. Einstein, S. A. Hobson, C. L. Matthews, R. E. Lee, A. Guardia and E. C. Bennett. Mr. C. L. Brainard rendered a vocal solo, and the Bell Telephone orchestra played. A moving-picture film entitled "Safety First" was exhibited by the United Railways Company. The organization has voted to change its name and will in future be known as the St. Louis Jovian League.

Meeting of Wisconsin Electrical Association.—Papers which should be of interest to all public utility men and subjects relating exclusively to electric service were presented at Milwaukee on Jan. 21 and 22 before the seventh annual convention of the Wisconsin Electrical Association. Among the papers which were presented were the following: "The Advertising Influence of Public Service Employees," by Mr. R. O. Jasperson; "Financing Public Utility Properties," by Mr. Andrew Cooke; "Continuous Meter Reading," by Mr. F. J. Maxwell; "Rate-Making for Both Gas and Electric Utilities," by Mr. E. N. Strait; "Increased Taxation in Wisconsin and Its Effect on Public Service Companies," by Mr. Edwin Gruhl; "Statistics on Workmen's Compensation Act," by Mr. Carl Muskat; "Rural Electric Service," by Mr. W. E. Haseltine; "Latent Water Powers and the Difficulties of Development Under the New Wisconsin Law," by Mr. J. S. Allen; "Advance in Street Lighting," by Mr. S. L. E. Rose; "How to Overcome Some Operating Difficulties of Small Electric Utilities," by Mr. J. N. Cadby and Mr. C. B. Hayden; "Practical Suggestions for Increasing the Efficiency of Small Steam-Electric Power Plants," by Mr. William F. Lathrop, and "Securing New Business," by Mr. C. M. Axford. Officers for the ensuing year were elected as follows: President, Mr. M. C. Ewing, Wausau; first vice-president, Mr. W. E. Haseltine, Ripon; second vice-president, Mr. B. F. Lyons, Beloit; third vice-president, Mr. A. E. Pierce, Eau Claire; secretary-treasurer, Mr. George Allison, Milwaukee.

Public Service Commission News

Kansas Commission

United States Senator Joseph L. Bristow will be appointed a member of the commission when his term in the Senate expires on March 4.

California Commission

The commission has ordered that the Coast Valleys Gas & Electric Company charge consumers in Monterey and Pacific Grove 8 cents per kw-hr. for the first 20 kw-hr. with a minimum service charge of $1 per month. The service charge is to be refunded if the customer receives energy continuously for twelve months at one location.

Oregon Commission

The commission has ordered the Molalla Electric Company to amend its schedule so as to provide that domestic heating appliances and small motors not exceeding 2 kw total connected load may be used as a part of the consumer's installation on his regular lighting meter.

Heretofore it has been the practice of the company in cases where small motors and domestic heating appliances are used on the premises of residence consumers using energy for lighting to insist upon the application of a separate schedule for energy consumed by such small motors and appliances. The resulting rate for domestic heating appliances and small motors (not exceeding 2 kw total connected load) is regarded by the commission as unjust and unreasonable.

Wisconsin Commission

In order to bring their capitalizations up to the values of their properties, the Wisconsin commission has authorized the West Allis Gas Company to issue $95,000 stock and the Manitowoc Gas Company $65,000 stock.

The Milwaukee Gas Light Company has been authorized to issue $1,500,000 first mortgage twenty-five-year 4 per cent gold bonds to replenish the depreciation reserve, against which expenditures for new construction, extensions and improvements have been charged. The bonds are to be sold for not less than 80.

The Madison Gas & Electric Company has been authorized to issue $650,000 bonds to be sold for not less than 90 to provide funds for extensions and improvements.

The confirmation by the State Senate of the appointment of Mr. Carl D. Jackson, of Oshkosh, as member of the commission has been postponed. Mr. Jackson, who is an attorney, was appointed to succeed Mr. John H. Roemer, the resignation of whom was announced recently.

Indiana Commission

Several bills have been introduced in the Legislature which provide for amendments to the utility law. Governor Ralston seems to be determined that the present law shall be upheld. Representative Lochry has introduced a bill seeking to place stock yards under the regulation of the commission. Certain sections of the appropriation bills apply to the commission, and some members, it appears, will attempt to reduce salaries of the commissioners, now paid $6,000 annually. A bill is proposed which would keep every member of the commission from taking part in politics. It is declared that Governor Ralston is backing his close friend and personal appointee, Mr. Thomas Duncan, of Princeton, chairman of the commission, for Governor in 1916. A bill has been introduced in the Senate to create a board of finance for the city of Indianapolis which would take over many of the powers of the City Council. The bill sought to take the control of rates and service of Indianapolis public utilities from the State commission, but will, it is declared, be so amended as to protect the authority of the State Commission.

Manila Commission

The Board of Public Utility Commissioners of Manila has rendered a decision dismissing the complaint of Mrs. E. Moffat against the Manila Electric Railroad & Light Company. The complainant contended that the consumption of electric energy as registered by six different meters installed in different premises should be combined in order that a cumulative discount might be received.

In its decision the commission upholds the minimum monthly charge as " a just compensation for the gratuitous

installation and use of the meter." It declared that to uphold the contention of the complainant would "constitute an unreasonable discrimination or preference" and "would give rise to combinations, difficult to avoid, on the part of the consumers, and to the detriment of the company, for the purpose of securing from the latter the largest cumulative discount possible in their respective electric-light bills."

New York Commissions

The Westchester Lighting Company filed an application on Jan. 25 for a rehearing of the case in which a decision was rendered recently by the New York Public Service Commission, Second District. An abstract of the decision of the commission in this case was published in the ELECTRICAL WORLD on Jan. 2, 1915.

The Second District Commission has issued an order requiring electrical corporations to have rate schedules printed and filed before Feb. 15. The order requires one title page. Where more than three rates are required a separate page must be provided for an index to service classifications. If it is impossible to get the full description of the territory covered on the title page, a separate page is to be provided for that. Another page is to be used for general instructions relating to the plan of the schedule. One page is to be used for rules and regulations of the company. A page is to be used for definitions, explanations, abbreviations and reference marks. A page is to be used for each rate which is known as the service classification. The minimum number of pages required in the order as issued would be five, which would apply to the schedules of the smallest companies.

The investigation of the commissions by the special committee of the Legislature was scheduled to start on Jan. 30 at a hearing to be held by the committee in the City Hall, New York.

Washington Commission

The fourth annual report of the commission, covering the year ended Nov. 30, 1914, says in part:

"Electric service in this State, with minor exceptions, is supplied through a few large companies by means of high-power lines extending in some instances hundreds of miles from the source of power to the point of consumption, and each community served is connected as a part of the whole system. For the commission to value such systems and equitably and justly apportion such value of the property used and useful in furnishing service to the different localities is a delicate task, requiring the most arduous and painstaking effort.

"The commission is now bringing to a close one such case, namely, the valuation of the property of the Pacific Power & Light Company. This company's holdings extend from Portland, Ore., throughout the Yakima Valley, running as far east as Walla Walla, Dayton and Pomeroy, and supplying light and power to forty different cities and towns, in addition to numerous irrigation plants. The segregation of the value of this property, the division between communities and the further division as between states, brings before this commission new principles of rate-making such as few, if any, commissions in the United States have been confronted with.

"Similar in the elements and conditions surrounding it is the property of the Washington Water Power Company of Spokane. This company, in addition to supplying Spokane with light and power, also furnishes service to cities and towns throughout the Inland Empire and to several towns and industrial plants in Idaho. Several of the towns that are being supplied with light and power by this company have filed petitions requesting an adjustment of rates. The commission has, therefore, filed a complaint for the valuation of the property of the company, and engineering work will soon be commenced.

"The complaint filed by the city of Spokane against the Washington Water Power Company for a reduction of rates was brought to a close through the efforts of the commission, the latter consenting to the dismissal of the case provided that a substantial reduction was made in rates to the consumers. The compromise schedule finally agreed upon carries a reduction in residential lighting rates of from 20 to 40 per cent, which, measured in dollars, will run considerably over $100,000 per year reduction."

Personal

Mr. A. L. Martin, manager of the Dallas division of the Oregon Power Company, Dallas, Ore., has been elected a member of the board of governors of the Dallas Commercial Club.

Mr. E. F. Stone, superintendent of light and power for the Arkansas Valley Railway, Light & Power Company, has been appointed chairman of the Manufacturers' Bureau of the Pueblo (Col.) Chamber of Commerce.

Mr. S. J. Dill, for many years connected with the Elmira (N. Y.) Water, Light & Railroad Company, and vice-president of the United Gas & Electric Corporation of New York, will on Feb. 1 transfer his office to New Orleans, La., and will assume charge of the work of the United Gas & Electric Engineering Corporation in the South.

Mr. J. S. Pevear, vice-president of the New Orleans (La.) Railway & Light Company, will on Feb. 1 transfer his headquarters to New York to become president of the United Gas & Electric Engineering Corporation as successor to Mr. George Bullock, who becomes chairman of the executive board. Mr. Pevear is already a vice-president of the engineering corporation. This transfer does not involve any change in the personnel of the United Gas & Electric Corporation, of which Mr. Bullock is still the president.

Mr. Howard C. Blackwell, who has been appointed to succeed the late H. H. Stannard as commercial engineer for G. M. Gest, New York, is a graduate of Cornell University. He has followed conduit and cable work from the time of his graduation in electrical engineering, first in the underground department of the Brooklyn Rapid Transit Company, and for eight years in Mr. Gest's organization. He has acted in various capacities for Mr. Gest and has supervised conduit and cable construction in more than seventy-five of the large cities in the East and in Canada. He was closely identified with Canadian work for the past four years, representing Mr. Gest as engineer in charge of the municipal work at Winnipeg and also for the city of Montreal, which work is still in process of construction.

Mr. M. C. Ewing, newly elected president of the Wisconsin Electrical Association, was born in Cleveland, Ohio, in 1869. He entered the public utility business at Wausau in 1906, aiding in the promotion and construction of the Wausau Street Railroad Company. In 1908 the electric-service and street-railway properties in Wausau were consolidated, and Mr. Ewing was made manager of the combined properties, which now consist of a 4500-hp water-power plant, a steam auxiliary station and a street-railway system with about 9 miles of track. In addition to his work in the public utility business at Wausau, Mr. Ewing also helped to promote and build the street-railway system at Grand Rapids, Wis., and the small system at Mankato, Minn.

M. C. EWING

Dr. Michael I. Pupin, director of the research laboratory of Columbia University, well known as the inventor of the Pupin loading coil universally employed in long-distance telephone service, was born Oct. 4, 1858, in Banat, in the southern part of Hungary, of pure Serb ancestry. Early in 1874, at the age of fifteen, he came to the United States, where he engaged in various lines of work and attended the evening schools in preparation for a college course. Five years later he entered Columbia University, from which he was graduated in 1883. He then studied mathematics and physics in the Universities of Cambridge, England, and Berlin, Germany, receiving from the latter the degree of doctor of philosophy in 1889. He returned to Columbia University as an instructor in mathematical physics and was made professor in 1891. Together with Prof. F. B. Crocker, he developed the electrical engineer-

ing department of Columbia, in which he does a large share of the work to-day. Among his first original work was the development of electrical resonance during the period from 1890 to 1895 before the introduction of wireless telegraphy. Patents issued to him on electrical selectivity were sold to the Marconi Wireless Telegraph Company in 1902. The Pupin "loading coil" or conductor was developed between 1894 and 1899. Several patents on loading coils issued to him during the following year and transferred at once to the American Telephone & Telegraph Company covered the broad principles of inserting inductance coils into telephone and telegraph wires and cables, and also methods of constructing the coils with iron cores sufficiently efficient for this kind of work. The machine necessary to put the windings on the coils was invented by Dr. Pupin and sold to the American Telephone & Telegraph Company. He devised the method adopted by the telephone company for testing the coils. The loading coils have been used for the last fourteen years all over the world and are considered by telephone and telegraph engineers as the most important development for long-distance work. In England, France and Germany his name is so linked with the discovery that new words have been introduced to designate the use of the telephone or telegraph conductors constructed in accordance with his invention, such as "Pupinized conductor," "ligne Pupinée" and "Pupinizirte Linien." For the past two years Dr. Pupin has been developing a system of wireless telegraphy based upon a new method of electrical selectivity. The work, which is progressing extremely well, would have been completed several years ago had the second Balkan war and the present European war not occurred. When Servia is at war Dr. Pupin abandons all scientific work and devotes himself entirely to the service of that country, of which he is now the honorary consul at New York.

Mr. Thomas Fitzgerald Kelly, the leading spirit in new-business co-operation of the Ohio Electric Light Association, was born at Hamilton, Ontario. In 1900 he entered the employ of the Hamilton Electric Light & Power Company as office boy and quickly advanced through the various departments to be contract agent of the company. That position he held from 1907 until January, 1913, when he resigned to become sales manager of the Dayton (Ohio) Power & Light Company. While at Hamilton Mr. Kelly was very active in civic affairs and in the work of the Canadian Electrical Association and the National Electric Light Association in Canada. He was the first chairman of the Commercial Section of the Canadian Electrical Association and organized a company section of the National Electric Light Association among the employees of the Hamilton Electric Light & Power Company, being appointed its first president. He was unanimously re-elected for the second term, resigning upon going to Dayton. Mr. Kelly was also one of the organizers of the Hamilton Ad Club, being its first secretary. At Dayton he has been very active in the affairs of the city, the Ohio Electric Light Association, the National Electric Light Association and the Jovian Order. Mr. Kelly is an active member of the Dayton Advertising Club and the Greater Dayton Association. In 1913 he was appointed chairman of the committee on new-business co-operation of the Ohio Electric Light Association, and because of his interest in this work he was re-elected chairman last year. In October, 1914, he was appointed by President H. H. Scott of the National Electric Light Association to be chairman of the Ohio membership committee of the association. Early last year Mr. Kelly was appointed statesman for Dayton of the Jovian Order by Jupiter W. N. Matthews, and at the annual convention at St. Louis last October he was appointed statesman for the State of Ohio. Mr. Kelly is also a member of the Engineers' Club of Dayton and of the Dayton City Club.

THOMAS F. KELLY

Corporate and Financial

Republic Railway & Light Notes.—White, Weld & Company of New York are offering at 98¾ secured 5 per cent gold notes of the Republic Railway & Light Company of New York.

Nevada-California Power Not to Issue Bonds.—At the request of the Nevada-California Power Company, the California Railroad Commission has dismissed the application to execute an open mortgage to secure an issue of first and refunding 6 per cent fifty-year gold bonds.

Yolo Water & Power Bond Offering.—White & Company, Inc., of New York, are offering at 90, with 40 per cent bonus of common stock, the unsold portion of the $2,500,000 Yolo Water & Power Company of Yolo County (Cal.) first mortgage 5 per cent sinking-fund gold bonds, due on Jan. 1, 1952.

Intermountain Railway, Light & Power Bonds.—Liggett, Hichborn & Company, of Boston, are offering at par and interest first mortgage 6 per cent gold bonds of the Intermountain Light & Power Company. The company is controlled and managed by the Associated Engineers' Company of Denver.

Baltimore Consolidated Supply Orders.—During 1914 the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., received 11,948 orders for electric service in comparison with 10,745 orders in 1913 and 9207 orders in 1912. The company made its best daily record on Sept. 30, 1914, with 104 orders.

Vermont Company's Exchange Agreement.—The Rutland (Vt.) Railway, Light & Power Company and the Vermont Marble Company have entered into an agreement whereby the two companies will exchange energy when desired. For this purpose a line is being constructed between the Proctor power station and the Mendon station.

American Light & Traction Dividends.—The American Light & Traction Company of New York has declared, in addition to the regular 2½ per cent dividend on the common stock, a stock dividend of 2½ per cent. The company also declared the regular 1½ per cent dividend on the preferred stock. The dividends are payable on Feb. 1.

Consolidated Gas Debentures.—The stockholders and others having the right to subscribe have subscribed to approximately 99 per cent of the $25,000,000 issue of convertible 6 per cent debenture bonds of the Consolidated Gas Company of New York. There are some stockholders in the Far West and Europe still to be heard from.

Pacific Gas & Electric Notes Sold.—Bond & Goodwin and Wm. A. Read & Company, both of New York, announce that the $4,000,000 of 5 per cent one-year gold notes of the Pacific Gas & Electric Company which they purchased recently have been sold. The proceeds will be applied to the redemption of the remaining $4,000,000 of one-year 5 per cent notes maturing on March 25, 1915.

Quebec-Jacques Cartier Electric Protective Committee.—The Quebec-Jacques Cartier Electric Company, having defaulted in the interest due on its first refunding mortgage 5 per cent thirty-year gold bonds, Dec. 1, 1914, the following bondholders' committee has been formed: Messrs. James B. Taylor, Alfred Wagstaff and William Thorne. Bondholders are requested to deposit their bonds with the Bankers' Trust Company of New York.

Southern Utility Bond Issue.—Shapker, Anderson & Company, of Chicago, are offering $925,000 Southern Utility Company first mortgage sinking fund 6 per cent gold bonds due on April 1, 1933. The issue, which is the entire amount outstanding, is part of an authorized issue of $20,000,000. The company owns and operates nineteen electric light and utility companies in Florida and two in Georgia, under the supervision of the J. G. White Management Corporation.

Consumers' Power Notes Sold.—The balance of the $953,000 issue of the 6 per cent bond-secured notes of the Consumers' Power Company of Minnesota having been sold as soon as they were offered at 99, by William P. Bonbright & Company of New York, and many applications left unfilled, the company sold an additional block of $500,000 to the bankers, which they are offering at the same price. The proceeds from the sale have been deposited with the trustees to provide for extensions and additions during 1915.

Cities Service Stock Decreased.—The outstanding stock of the Cities Service Company of New York has been decreased by $1,200,000 preferred stock and $1,000,000 common stock, owing to the redelivery to the treasurer of the company of stock held to finance the purchase of the stock of the St. Joseph Railway, Light, Heat & Power Company. The balance due is now being put into bills payable, extended over a period of one-half year.

American Gas Offers Stock to Shareholders.—The American Gas Company of Philadelphia has offered to stockholders of record Jan. 25, 1915, the right to subscribe to new stock at par to the extent of 20 per cent of their holdings. The proceeds will be used to pay for improvements and extensions. Payment for the stock is to be made as follows: 50 per cent on Feb. 17, 1915, and 50 per cent on or before June 1, 1915. For all payments made on Feb. 17, 1915, negotiable temporary receipts will be issued paying interest at 7 per cent up to June 1, 1915, when regular certificates for stock will be issued. The right to subscribe expires on Feb. 17, 1915. The entire issue has been underwritten.

Westinghouse Machine Deposits Time Extension.—The time for the deposit of the Westinghouse Machine Company stock to be exchanged for Westinghouse Electric & Manufacturing Company's stock, which expired Jan. 26, has been extended until Feb. 9. A letter to the machine company's stockholders stated that 87 per cent of the outstanding stock of their company had assented to the agreement dated Dec. 26, 1914, providing for the exchange of the machine company's stock for common stock of the electric company at the rate of three shares of machine stock to one share of electric company's stock. A committee of minority stockholders who have not yet agreed to the exchange of the stock has been appointed to confer with Mr. H. H. Westinghouse.

Virginia-Western Power Note Offering.—The Chicago Savings Bank & Trust Company is offering $50,000 Virginia-Western Power Company two-year 6 per cent notes due on July 1, 1916. The company serves exclusively in Virginia the towns of Lexington, Buena Vista, Clifton Forge, Iron Gate and Covington, and in West Virginia Ronceverte, Lewisburg and Alderson. The purpose of the note issue is to provide funds for connecting all of these cities on the transmission line which will distribute energy from a central plant at Clifton Forge. The work has been completed from Clifton Forge to Alderson, and it is the intention of the company to complete the work from Clifton Forge to Lexington and Buena Vista this spring. The company's earnings are already beginning to increase, although the work was retarded somewhat by financial conditions last year.

Idaho-Oregon Light & Power Sold.—The property of the Idaho-Oregon Light & Power Company, Boise, Idaho, was sold on Jan. 18 for $2,605,000 to the Electric Investment Company, a Delaware concern organized for the purpose. The purchasing company is controlled by a group known as the minority bondholders, which was organized by Mr. A. W. Priest, Appleton, Wis., who secured later a majority of the bonds of the Idaho-Oregon company. The sale was made under the direction of Mr. R. M. McCracken, special master appointed by Judge Dietrich of the federal court. The only opposing bidder was Mr. Niel A. Wethers, who is said to represent owners of the rival company in Boise. It is stated that the purchasers will improve the property and complete the Oxbow plant, which is expected to furnish most of the energy. It is estimated that 30,000 hp will be required.

United States Public Service Note Offering.—John Nickerson, Jr., of New York, is offering $1,200,000 of 6 per cent collateral-lien gold notes of the United States Public Service Company of St. Louis, Mo. The notes are dated April 1, 1913, and due April 1, 1915. The United States Public Service Company is controlled by the Light & Development Company of St. Louis, through stock ownership. The company operates properties in a number of cities in Missouri, including St. Louis, and also in Kentucky, South Dakota, Illinois and Ohio. The value of the company's property, as estimated by H. M. Byllesby & Company, using depreciating values for the physical property, is $2,509,672. Since the Byllesby valuation the company estimates that it has acquired new property to the value of $1,000,000. The common stock of the United States Public Service Company outstanding amounts to $4,550,000, and the preferred stock amounts to $2,025,000. The funded debt, including the first issue, amounts to approximately $1,900,000.

Duquesne Light Convertible Note Issue.—Blair & Company and Ladenburg, Thalmann & Company, both of New York, are offering at 97¼ and interest $2,500,000 of Duquesne Light Company of Pittsburgh three-year 5 per cent convertible gold notes, due Feb. 1, 1918. The notes are convertible at any time until maturity into the 7 per cent cumulative preferred stock of the company, par for par. The company is capitalized for $21,092,000 common stock, the present issue of $2,500,000 5 per cent convertible gold notes and $2,500,000 6 per cent notes. The proceeds from the sale of the present issue are to be used to retire $208,551 of floating indebtedness as of Dec. 31, 1914, incurred in construction work and to pay for improvements, extensions and betterments to the company's property. A statement for the year ended Dec. 31, 1914, showed net income applicable to interest charges of $1,840,655.

Annual Report of Lehigh Valley Transit Company.—Owing to the State requirement of a form of income statement for the fiscal year ended Nov. 30, 1914, different from previous years, the usual three-year comparison has been omitted. Figures are given for only one year. President H. R. Fehr states that the light and motor-service business continues to be satisfactory. During the year the company acquired all the outstanding stock and bonds of the Lehigh County Electric Company, the Northampton County Electric Company and the Cementon Electric Light & Power Company, thus having control of electric service in Catasauqua, North Catasauqua, Northampton, Coplay, Egypt and Cementon. Companies were incorporated in Bethlehem, Freemansburg, Hellertown, Lehigh Township and Walnutport. The company has also made applications for charters for companies in the townships of Franconia, Lower Macungie, Lower Milford and West Rockhill. Outstanding stock amounts to $7,977,037 and the outstanding funded debt amounts to $11,448,447. The income statement for the year ended Nov. 30, 1914, follows:

Transportation revenue	$1,524,770
Energy-sales revenue	344,236
Total	$1,869,006
Expenses, including taxes	1,150,655
Operating income	$718,351
Other income	122,948
Gross income	$841,299
Interest, rent, amortization, etc.	633,178
Net income	$208,121

Manufacturing and Industrial

The American Industrial Company, 30 Church Street, New York, has appointed Mr. N. S. Whitehead president.

Mallory, Mitchell & Faust, advertising agents, is the name of the concern formerly known as Mallory & Mitchell.

Mr. E. P. Roberts will open an office for consulting-engineering work about Feb. 1. His temporary address is 2053 East Ninety-sixth Street, Cleveland, Ohio.

The Fairmount Electric & Manufacturing Company, Philadelphia, Pa., has changed its address from 2202 Pearl Street to Fifty-ninth Street and Woodland Avenue.

Mr. Roger Williams, agent for the Simplex Electric Heating Company in New York, recently moved from 25 West Forty-second Street, to 120 West Thirty-second Street.

The Adams-Bagnall Electric Company, Cleveland, Ohio, has appointed Mr. V. M. Marker in charge of its Chicago office. Mr. Marker was formerly in charge of the Minneapolis office of the company. He will still have supervision over the Northwestern territory besides that covered by the Chicago office, his district extending from Chicago to the Pacific Coast.

The Quaker City Engineering Company, Philadelphia, Pa., which was recently formed, is a firm of electrical and mechanical engineers and contractors. The company is engaged in the installation of mechanical and electrical apparatus and general machine work, both mechanical and electrical. Mr. E. H. Danzeisen is superintendent and Mr. H. A. Pickel is consulting engineer for the company.

Automobile Company Signs Magneto Contract.—One of the sensational announcements made at the Chicago Automobile Show was given out by the Splitdorf Electrical Company, Jan. 25, stating that the Willys-Overland Company, of Toledo, Ohio, had contracted to use Splitdorf magnetos and spark plugs exclusively in its 1915 output. This order, according to Mr. C. W. Curtis, general manager of the Splitdorf Company, is one of the largest ever placed for automobile ignition accessories.

Roebling's Trenton Plant to Be Rebuilt.—According to Mr. F. J. Newbury, of the John A. Roebling's Sons Company, Trenton, N. J., that part of the company's plant which was recently destroyed by fire will be rebuilt as soon as possible. In a recent letter to the ELECTRICAL WORLD Mr. Newbury stated that the fire wiped out the company's weatherproof department, telephone-cable department, paper-insulated-cable department and lead shop. Mr. Newbury also said that the company has made arrangements to supply its customers with the materials that they have been buying from it heretofore.

Consolidation of Electrical Contracting Companies in Chicago.—The birth of the Hub Electric Company, 1819 Carroll Avenue, Chicago, to which articles of incorporation were granted Jan. 1, marked the cessation of the business of the following well-known Chicago contracting firms: Samuel Benson, 2205 North California Avenue; J. P. Kerns, 3758 West Twenty-second Street; Alex M. Knauber, 1642 West Madison Street; R. C. Bierdemann, 4621 North Clark Street; F. L. Decker, 2806 Sheffield Avenue, and Franklin Waidner, 1619 Juanita Street. All buying and distributing is now done from the one central source. Mr. W. J. Collins is manager of the new company, and the owners of the discontinued businesses are all members of the new firm.

Bronze Department for Alloy Company.—The Titanium Alloy Manufacturing Company, Niagara Falls, N. Y., has recently organized a bronze department for the production of various types of brass and bronze castings. This department will be under the management of Mr. W. M. Corse, formerly works manager of the Lumen Bearing Company of Buffalo. The above company has also appointed Mr. H. R. Corse its sales representative, with headquarters at 912 Ford Building, Detroit, Mich. The company is specializing particularly in aluminum bronzes. Its titanium-aluminum bronze, it is reported, has a tensile strength of 70,000 lb. per sq. in., an elongation of 20 per cent, and a specific gravity of 7.5. Aluminum bronze is one of the two bronzes with high tensile strength on the market at the present time, the other alloy being manganese bronze.

Mr. James H. Hughes, secretary of E. B. Latham & Company, recently resigned his position with that company to assume the general managership of the Alpha Electric Company, Inc., 116 West Twenty-ninth Street, New York City. Mr. Hughes has been identified with the electrical business for the past twenty years and has a wide acquaintance in that field. He began his career twenty years ago when he entered the employ of J. H. Bonnell & Company. After being with this company for some time, he identified himself with the Manhattan Electrical Supply Company, then at 36 Cortlandt Street, New York City, acting in the capacity of buyer for this company for three years. In 1899 he accepted an interest in the firm of E. B. Latham & Company and continued with that company in the capacity of secretary for fifteen years, when he resigned to enter his present business.

The Kennedy-Stroh Corporation, Pittsburgh, Pa., has recently been formed with a capitalization of approximately $2,500,000, and has taken over the Kennedy Manufacturing & Engineering Company of New York, the Stroh-Steel Hardening Process Company, the Lawrence Steel Casting Company and the Best Manufacturing Company of Pittsburgh, Pa. The main plant of the company will be at Oakmont, Pa., and will include the buildings formerly owned by the Best Manufacturing Company. The plant of the old Lawrence Steel Casting Company will also be operated and will be known as the Lawrence department. Mr. W. H. Schoen, formerly with the Schoen Pressed Steel Company (now the Pressed Steel Car Company), is president of the new company. Mr. J. E. Kennedy is vice-president, Mr. J. L. Kendall treasurer, Mr. J. D. Hiles, for the past fourteen years with the Best Manufacturing Company, secretary, and Mr. W. Y. Stroh, of the Stroh Steel Hardening Process Company, general manager and metallurgist. Sales will be handled by Mr. C. L. Straub and Mr. H. A. Johann for the Kennedy manufacturing and engineering department, by Mr. John M. Sherrard and Mr. O. L. Mills for the Stroh steel-hardening-process department, by Mr. W. H. Green for the Lawrence steel-casting department, and by Mr. B. Floersheim and Mr. J. W. Prenter for the Best manufacturing department Extensive additions are being made to the two above plants, and when the improvements are completed some 2000 men will be employed.

Automatic Electric Company Celebrates Twenty-third Anniversary.—At the annual meeting of the employees of the Automatic Electric Company, Chicago, manufacturer of automatic telephone equipment, held at the Auditorium Hotel Jan. 16, Mr. H. D. Critchfield, president of the company, announced that eighty-five cities have now been equipped with the company's automatic telephone system, making a total of 85,000 lines. Five of these cities are in Australia, one is in India, two are in Canada, and one is in the Argentine. President Joseph Harris presented gold watches to fifteen employees as rewards for valuable suggestions made by them during the year which have increased the efficiency of the manufacturing methods of the company. Thirty-four other employees were rewarded with gold-handled and silver-handled knives. The Automatic company has just reached its twenty-third anniversary.

Motion Pictures in New York Subway with Twin-Arc Lamps.—Twelve twin-arc lamps were used on the evening of Jan. 25 to take motion pictures in the New York subway. These lamps represent a recent development and are equipped with especially treated electrodes for photographic work. The electrodes are arranged in series and the lower pair is stationary and the upper pair movable. The upper pair of electrodes are kept in position by means of a solenoid. Each lamp takes 1500 watts at 100 volts, and according to Mr. J. W. Allison of Allison & Hadaway, the makers of the lamp, gives 8000 cp. The pictures were taken by the Vitagraph Company of America, and they will be shown in connection with New York City's exhibit at the Panama-Pacific exposition. Between 5:45 p. m. and 6:15 p. m. pictures were made of the crowds on the north-bound side of the Grand Central station of the subway. Later in the evening the twelve lamps were installed on a flat car and were arranged in two groups, six of each group being connected in series to the third-rail circuit. The motion-picture apparatus was also mounted on this car and pictures were taken of various parts of the subway while the car was moving. Pictures were also recently made of the McAdoo tunnel by the Vitagraph Company. According to Mr. Tefft Johnson, director of the Vitagraph Company in charge of the taking of the pictures in the subway, it has only recently been possible since the development of the twin-arc lamps to take such pictures.

NEW YORK METAL MARKET PRICES

	Jan. 19 — Selling Prices Bid	Asked	Jan. 26 — Selling Prices Bid	Asked
Copper:	£ s d		£ s d	
London, standard spot*	60 15 0		63 5 0	
Prime Lake	13.75	to 14.00	14.25	to 14.50
Electrolytic	13.65	to 13.75	14.12½	to 14.25
Casting	13.50	to 13.60	13.87½	to 14.00
Copper wire base	.....	to 15.00	.....	to 15.50
Lead	3.70		3.70	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	9.00		9.50	
Spelter, spot	6.25	to 6.30	.....	to 7.50†
Straits tin	33.87½		35.62½	
Aluminum, 98 to 99 per cent	18.75	to 19.25	18.75	to 19.25

*OLD METALS

Heavy copper and wire	12.25	12.50
Brass, heavy	8.75	8.75
Brass, light	7.62½	7.75
Lead, heavy	3.52½	3.50
Zinc, scrap	4.75	5.25

COPPER EXPORTS

Exports of copper in form of pigs, ingots, bars, plates, and scrap for week ending Jan. 16, 1915 ..... 7,836,750 lb.

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Manning Light & Ice Company, of Manning, S. C., has been chartered with a capital stock of $15,500 by L. H. Harvin and S. Oliver O'Bryan.

The Quattlebaum Light & Ice Company, of Conway, S. C., has been incorporated with a capital stock of $30,000 by Paul Quattlebaum, McQueen Quattlebaum and C. P. Quattlebaum.

The Mutual Electric Company, of Flat Rock, Ind., has been incorporated by Roy M. Nading, Bruce D. Wright and J. M. Harrod. The company is capitalized at $2,500 and proposes to supply electricity in Flat Rock.

The Dallas Electric Company, of Dallas, Wis., has been organized with a capital stock of $10,000 for the purpose of supplying electricity for lamps and motors in Dallas. A. S. Pelton is president of the company and Dr. Thacher secretary.

The Mutual Electric Company, of Middleport, Ohio, has been incorporated with a capital stock of $10,000 by O. E. Harrison and others. The company is capitalized at $10,000 and proposes to install a distributing system in Middleport. Electricity to operate the system will be obtained from the plant in Floodwood.

The New Brighton Electric Company, of New Brighton, Minn., has been incorporated by Fred Jesner, W. M. James, F. M. Searles, James E. Treat and J. W. Jandell. The company is capitalized at $10,000 and proposes to generate electricity and distribute same for lamps, heaters and motors; also to operate a telephone system.

New Industrial Companies

The Western Storage Battery Company, of Lincoln, Neb., has been incorporated with a capital stock of $2,000 by F. C. Miller, E. D. King and J. R. Robb.

The Manitowoc Electric Implement Company, of Manitowoc, Wis., has been granted a charter with a capital stock of $20,000 by George P. Brunner, Joseph Brunner and Frank Brixius.

The Turbine Engine Manufacturing Company, of Chicago, Ill., has been incorporated by W. S. Stewart, S. B. Hill and J. A. Brown. The company is capitalized at $100,000 and proposes to manufacture turbine engines.

The Sylvan Electric Bath, of Brooklyn, N. Y., has been granted a charter with a capital stock of $100,000. The incorporators are George Beuckle, John G. Singer, William G. Herx and others. Kiendl, Smyth & Cross, 215 Montague Street, Brooklyn, are attorneys.

The Car Lighting Company, of New York, N. Y., has been chartered with a capital stock of $100,000 for the purpose of dealing in railroad equipment, electrical work, fixtures, etc. The incorporators are L. W. Young, W. H. Black and W. P. Horn, of New York, N. Y.

The Wilson Automatic Call Company, of Cooperstown, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical devices and telephone systems, etc. The incorporators are W. E. L'Hommedieu, J. W. Wilson and J. M. Lynch, of Cooperstown, N. Y.

The C. H. B. Advertising Company, of Brooklyn, N. Y., has been incorporated with a capital stock of $10,000 by Agnes R. May, E. M. James and M. M. Eisenberg, 457 Hopkinson Avenue, Brooklyn, N. Y. The company proposes to manufacture and deal in electrical and mechanical devices and novelties.

The Imperial Chandler Company, of New York, N. Y., has been incorporated with a capital stock of $5,000 by Annie Phillips, Nicola De Marco, 332 West Twenty-sixth Street, New York, and Louis B. Sherman, 673 Snediker Avenue, Brooklyn, N. Y. The company proposes to deal in brass gas and electrical fixtures.

The D. G. C. Trap & Valve Company, of New York, N. Y., has been chartered with a capital stock of $25,000 by A. A. Cryer, of New York; J. H. Eastwood, of Belleville, N. J., and G. Livingston, of Jobstown, N. J. The company proposes to install plumbing, steam heating, ventilating, electric apparatus, drying and refrigerating systems.

Trade Publications

Copper Data.—"Copper History as Told in Prices" is the title of a leaflet compiled by the Rome Wire Company, Rome, N. Y.

Steam Valves.—Jenkins Brothers, 80 White Street, New York, have issued a booklet which describes a number of steam valves.

Reflectors.—A number of reflectors for incandescent lamps are listed in a folder being sent out by Harvey Hubbell, Inc., Bridgeport, Conn.

Scale Knocker.—W. N. Matthews & Brother, St. Louis, Mo., have issued a leaflet describing and illustrating a device for knocking the scale off boiler tubes.

Electric Iron.—The Pelouze Manufacturing Company, 232 East Ohio Street, Chicago, Ill., is sending out a folder which describes its 500-watt electrically operated iron.

Boring Machine.—The Henderson Electric Company, Ampere, N. J., is distributing several leaflets describing its portable machine for boring holes for wiring purposes.

Circuit-Breakers.—"When a Fuse Blows Replace It with an I-T-E Circuit-Breaker" is the title of a catalog recently issued by the Cutter Company, Philadelphia, Pa.

Electric Pump.—Bulletin No. 119, distributed by the Goulds Manufacturing Company, Seneca Falls, N. Y., contains information on a recently developed motor-driven pump.

Electric Search-Lamp.—The Carlisle & Finch Company, Cincinnati, Ohio, has issued a folder which lists and illustrates several types of search-lamps for yachts and motor boats.

Porcelain Insulators.—The Pittsburgh High-Voltage Insulator Company, Derry, Pa., is sending out its Catalog No. 3, which contains information on high-potential porcelain insulators.

Electric-Railway Line Material.—The General Electric Company, Schenectady, N. Y., has recently issued Bulletin No. 44,044, which lists a number of devices for electric-railway direct suspension.

Waterwheels.—Various kinds of waterwheels and a number of waterwheel installations are described and illustrated in Bulletin No. 8 issued by the Pelton Water Wheel Company, San Francisco, Cal.

Oil-Testing Set.—The General Electric Company, Schenectady, N. Y., has just issued Bulletin No. 49,901, describing an oil-testing set by means of which the dielectric strength of oil can be determined.

Sign Equipment.—The Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill., is distributing a placard designated as Suggestion No. 11, which contains information on electric-sign equipment.

Fluoroscope.—The Kelley-Koett Manufacturing Company, Covington, Ky., is sending out two folders, one of which contains illustrations of its vertical fluoroscope and the other of accessories for the instrument.

Diesel-Engine Plant.—"A Complete Power Plant" is the title of Bulletin No. 55 issued by the McIntosh & Seymour Corporation, Auburn, N. Y. The bulletin describes the complete equipment of a Diesel-engine plant.

Horizontal Steam Turbines.—The construction and operation of horizontal steam turbines and methods of lubricating and caring for oil are described in a folder recently prepared by the Vacuum Oil Company, Rochester, N. Y.

Adjustable-Arm Lamp Holder.—The American Electric Company, Chicago, Ill., has issued a booklet entitled "The Remarkable Growth of an Idea," which contains information on its adjustable-arm lamp bracket and other devices.

Line Transformers.—The Pittsburgh Transformer Company, Pittsburgh, Pa., has issued Bulletin No. 1380, which is entitled "Experiences with Line Transformers," and is a reprint of a paper read before the A. I. E. E. on May 29, 1914.

Hydraulic Turbine.—The Hydraulic Turbine Corporation Company, Camden, N. J., has issued an attractively illustrated forty-page catalog designated as Catalog D, which describes various types of hydraulic apparatus that it is placing on the market.

Construction News

New England

AUBURN, MAINE.—The installation of a municipal electric-light plant in Auburn is reported to be under consideration. The use of a vacant school building has been suggested for a steam-driven electric generating plant; also the construction of a power station on Taylor Brook on the Nezinscott River to develop the water-power to generate electricity. The cost of equipping the school building with a steam plant is estimated at $50,000.

BRIDGEWATER, CONN.—Application has been made to the State Legislature for a charter for the Bridgewater Pwr. Co. by J. H. Lancaster and others, of Lancaster. Authority is asked to construct a dam 40 ft. high, across the Housatonic River in the towns of Bridgewater and Brookfield. The company proposes building a hydroelectric plant and supplying electricity in the towns of Bridgewater and Southbury; also to transmit and sell energy to the boundary lines of any city, town or borough in the counties of Litchfield, Fairfield and New Haven. The capital stock is placed at $500,000.

MERIDEN, CONN.—The Meriden El. Lt. Co. expects to erect a 4600-volt, three-phase, 60-cycle transmission line to a city reservoir, 4 miles distant, to supply electricity for pumping station, in the early spring. The company also contemplates an extension to its underground conduit system this year, the work to begin about April 10. Charles A. Learned is general manager.

NORWICH, CONN.—The City Gas and Electric Department has begun work on the erection of a transmission line to the town of Yantic to supply electricity for lighting the town. The street-lighting system will consist of 27 nitrogen incandescent lamps. S. J. Kehoe is superintendent.

WALLINGFORD, CONN.—Within the next six months the Board of Electric Light Commissioners expects to erect a single-phase transmission line to Clintonville, a distance of about 5 miles; also to install about 12 miles of fire-alarm circuits, a new four-circuit switchboard (Gamewell) and to rebuild the present system completely. Steps will also be taken to promote the use of electrical appliances, including heating and cooking apparatus, vacuum cleaners, washing machines, etc. A. L. Pierce is superintendent and electrical engineer.

Middle Atlantic

BALDWINSVILLE, N. Y.—The Village Trustees are negotiating with the Seneca River Pwr. Co. for the installation of a new street-lighting system. The plans provide for replacing the arc lamps now in use with incandescent lamps, the number of lamps to be doubled.

BINGHAMTON, N. Y.—The Board of Contract has voted to accept the proposal of the Binghamton Lt., Ht. & Pwr. Co. for street-lighting for one year. The board reserves the right to continue the agreement for three years if the city should wish to.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Feb. 1, for installing electric equipment in new Public School 50, corner of Driggs Avenue and South Third Street, Brooklyn. Blank forms, plans and specifications may be obtained at the above office, and also at branch office, 131 Livingston Street, Brooklyn.

LA SALLE, N. Y.—The Village Board has engaged W. J. Miles, electrical engineer, of Buffalo, to prepare preliminary plans for a municipal electric-lighting plant in La Salle.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of schools, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Feb. 1, for installing electrically operated ash hoists at Public Schools 45, 50, 52 and 53, borough of the Bronx, and for installing electric equipment in new Public School 91, Central Avenue, between Folsom and Fosdick Avenues, Glendale, borough of Queens. Separate bids must be submitted for each school. Blank forms, plans and specifications may be obtained at the above office and also at branch office, 69 Broadway, Flushing, borough of Queens.

NEW YORK, N. Y.—Bids will be received by the board of trustees of Bellevue and Allied Hospitals Department of New York City, 415 East Twenty-sixth Street, New York, until Feb. 5, for furnishing labor and materials necessary for the excavation, masonry, carpentry, steel and iron work, metal work and roofing, painting and glazing, hardware, electric work, refrigerating and drinking water, and all other work for the alterations to the present main building of the Harlem Hospital, 136th and 137th Streets and Lenox Avenue, borough of Manhattan. Bids will also be received for plumbing and gasfitting for additions and alterations to the present main building of the above hospital. Blank forms and further information may be obtained at the office of the contract clerk, 400 East Twenty-ninth Street, borough of Manhattan.

ALLENTOWN, PA.—The electrical contract for the nurses' home and for the administration building of the State Homeopathic Hospital for the Insane at Rittersville, near this city, has been awarded to R. W. Keck & Co., of Allentown.

DUNLO, PA.—Plans are being prepared by local business men for the installation of a new lighting system to replace the service now furnished by the Dunlo Lt., Ht. & Pwr. Co. Options have been taken on a site and a charter will soon be applied for. It is proposed to supply electrical service to nearby towns as well as in Dunlo.

HARRISBURG, PA.—The electrical department of the Harrisburg Pipe & Pipe Bending Works was damaged by fire on Jan. 22, causing a loss of about $15,000. Reconstruction work, it is reported, will be started in the near future.

MOUNT WOLF, PA.—The Borough Council is considering the question of submitting the proposal to issue $5,000 in bonds for the installation of an electric-lighting plant.

PHILADELPHIA, PA.—The contract for the construction of power house at the Home for the Indigent at Holmesburg has been awarded to W. W. Anstine & Co., of Philadelphia, at $56,537, and for the mechanical system to Charles E. Monday, for $72,400.

PHILADELPHIA, PA.—Plans have been prepared, it is reported, by W. E. S. Dyer, architect and engineer, Land Title Building, Philadelphia, for the construction of a power station and boiler house, at Hancock and Berks Streets, for the Philadelphia Dye Works. The equipment will include generators, boilers, smokestacks, motors, etc.

WILKES-BARRE, PA.—The board of directors of the Wilkes-Barre Private Ward Hospital has awarded the electrical contract for the proposed new hospital building to Shepard & Rust, electrical engineers and contractors, of Wilkes-Barre. The plans provide for an indirect lighting system throughout the building, power installation for motors, heating apparatus, vacuum cleaning system, ventilating system, nurses' signaling system, passenger and freight elevators and for electrotherapeutic work and X-ray apparatus.

ALLENHURST, N. J.—Plans are being prepared, it is reported, by Joseph B. Rider, 29 Broadway, New York, N. Y., for the construction of an electric-light plant in Allenhurst.

BUTLER, N. J.—Bids will be received by the lighting committee of the borough of Butler, addressed to D. D. Smithyman, borough clerk, Municipal Building, Butler, until Feb. 15 for furnishing material and labor for the construction of the municipal electric-lighting plant in accordance with plans and specifications prepared by Runyan & Carey, consulting engineers, 845 Broad Street, Newark. Proposals may be submitted for any one of two divisions or for the entire installation as follows: (1) For power station building, including excavation, septic tank, building and machinery foundations; (2) oil engines, generators, switchboards, constant-current transformers and wiring between generators, exciters and switchboard to inside connection with lightning arresters; (3) electrical work, including station-lighting wiring, outside distributing system, including lightning arresters, poles, wire, street fixtures, etc.

PERTH AMBOY, N. J.—An ordinance has been passed by the Board of Aldermen authorizing an issue of $150,000 in bonds for the construction of a municipal electric-lighting plant. At the November election the citizens voted in favor of municipal ownership of the electric-lighting system.

RED BANK, N. J.—The Borough Council has awarded the Public Service El. Co. a contract for street-lighting for a period of five years. The new contract provides for replacing the arches now in use with 400-cp and 600-cp nitrogen incandescent lamps: 36 600-cp and 60 400-cp lamps will be installed.

MIDDLETOWN, DEL.—Within the next six months the Water and Light Commission expects to purchase a 30-kw generator and 50-hp engine. D. W. Stevens is clerk.

FREDERICKSTOWN, MD.—The local electric-light plant is reported to have been purchased by W. R. and Perry Patterson. The new owners, it is understood, will build an ice factory and bottling plant in connection with the electric plant.

MOUNT AIRY, MD.—Plans are being considered by Robert L. Runkles and C. C. Riddlemoser for the installation of an electric plant in connection with their ice plant. They propose to supply electricity for lamps in Mount Airy and Ridgeville.

HAMPTON, VA.—The City Council is considering the question of extending the electric-lighting system.

KENBRIDGE, VA.—The franchise for an electric-light plant, recently sold by the city, has been purchased by W. H. Erickson, of West Virginia. Machinery for the proposed plant, it is understood, has already been purchased. An ice factory will also be operated in connection with the proposed electric plant.

WASHINGTON, D. C.—The House committee on accounts has voted to recommend an appropriation of $30,000 to install an electrical voting device in the House of Representatives. The device was invented by Representative Walsh of New Jersey.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 12 for supplying to the various public buildings under the control of the Treasury Department portable vacuum cleaners during the fiscal year ending June 30, 1915. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 15 for furnishing and installing lighting fixtures in the United States post office at Bangor, Maine; United States post office at Berkeley, Cal.; United States post office and court house at Chickasha, Okla.; United States post office and court house at Clarksdale, Miss.; United States post office and court house at Minot, N. D.; United States post office at New Bedford, Mass.; United States post office at Piqua, Ohio, and United States post office at Winston-Salem, N. C. For details see proposal columns.

WASHINGTON, D. C.—In view of the disorganization or cutting off of sources of supply of electrical machinery and appliances imported into South Africa, a series of tables has been prepared for the benefit of American manufacturers giving all available details concerning the various electric lighting and power plants, 51 in number, in operation in South Africa at the end of 1913. A few additional plants were installed during 1914, particulars with regard to which will be forwarded when obtained. Copies of the lists may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 15,312—An American consul in Europe has transmitted a detailed report relative to possibilities for the sale of American electrical supplies, excavating, hydraulic and mining materials in his district. No. 15,327—An American consular officer in Latin America reports the name of an engineer in his district who has recently been put in charge of all government construction work. The engineer desires to receive catalogs, price lists, etc., in English, on road machinery, rock crushers, sump cars, instruments for surveyors, etc., electrical meters, etc. No. 15,369—An American consular officer in a foreign country reports that the managing director of an electric company in his district has requested that he be placed in communication with American manufacturers of carbon black. It is stated that the company is now in the market for from 80 tons to 90 tons of carbon, and that if satisfactory arrangements can be made it will require from 320 tons to 400 tons per annum. Correspondence should be in Russian, French or German. No. 15,374—An American consular officer in Canada reports that a firm in his district wishes to purchase an electric auto-compressor capable of sustaining 150 lb. pressure and supplying 6 cu. ft. of free air per minute. No. 15,356—A business man in Russia informs an American consul that he is interested in electric lamps, oil stoves, keys, etc. He desires the names and addresses of American firms which are in a position to offer him an agency in these lines. Correspondence may be in English, French or German. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or to its following branches: United States Custom House, New York, N. Y.; 752 Oliver Building, Boston, Mass.; Federal Building, Chi-

cago, Ill.; Third National Bank Building, St. Louis, Mo.; Post Office Building, Atlanta, Ga.; Hibernia Bank Building, New Orleans, La.; United States Custom House, San Francisco, Cal., and Alaska Building, Seattle, Wash.

North Central

DETROIT, MICH.—Plans for the new municipal courts building, to cost $600,000, submitted by Smith, Hinchman & Grylls, have been approved by the Council committee on buildings. It is announced that work will begin on construction of the building within 30 days.

ESSEXVILLE, MICH.—The installation of a new street-lighting system in Essexville is under consideration.

JACKSON, MICH.—The city of Jackson is considering the advisability of relaying several blocks of pavement on Main Street in the downtown section, and if it is done this year will probably install underground conduits for the ornamental lighting system. As yet nothing definite has been decided upon. C. E. Chapell is city manager.

LANSING, MICH.—The report of Prof. F. W. Blackmar, of the State University, chairman of the prison commission, filed with Governor George H. Hodges, recommends the installation of a new power plant (to cost about $50,000) at the State Penitentiary in Lansing.

SAGINAW, MICH.—The City Council has called a special election to be held Feb. 17 to vote on the proposal to issue $500,000 in bonds for the installation of a municipal electric-lighting plant.

ATHENS, OHIO.—The Davis Paving Block Co. is reported to be planning the construction of a large plant west of the city. The works will cover 11½ acres and will provide for factory, kilns, drier, etc. Arrangements, it is said, will be made with the Hocking Pwr. Co. of Nelsonville to supply energy to operate the proposed plant.

BOWLING GREEN, OHIO.—Bids will be received by D. C. Brown, of Napoleon, secretary of board of trustees of Bowling Green State Normal College, Bowling Green, until Feb. 12, for construction of a fireproof power station, stack, tunnel, tunnel system, water supply and softening plant, electrical work, gas fittings, steam mains, pumps, etc., according to plans and specifications on file at the office of the secretary of the board, Napoleon; also at the office of Victor Donahey, State auditor, Columbus, and Howard & Merriam, architects, 8 East Broad Street, Columbus.

CANTON, OHIO.—Extensive improvements and extension of lines, involving an expenditure of $250,000, are contemplated by the Canton Gas & El. Co. during the coming year. The work will include the installation of several new boilers, new machinery for central heating plant and new coal-handling machinery, and possibly an additional generator. W. C. Anderson is manager.

CINCINNATI, OHIO.—The contract for remodeling the temporary power house of the hospital on Burnett Avenue has been awarded to J. B. Schmitt at $5,305.

CLEVELAND, OHIO.—The appropriation for the division of light for the city of Cleveland for 1915 amounted to $691,100, of which $141,400 is for new equipment including meters and settings, $18,000; poles, line, transformers, $74,000; arc lamps, $10,000; service connections, $16,000, and underground construction, $5,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until Feb. 4, for furnishing two 3-ton motor trucks for the division of street repairs. Specifications, plans and bidding blanks may be obtained at the office of the superintendent of street repairs, 311 Superior Avenue, N. E., City Hall.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until Feb. 5, for storage battery set to operate electric switches and signals for substation, for the Municipal Electric Light Department, in accordance with specifications which may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street.

COLUMBUS, OHIO.—Plans are being considered by the commissioners of Franklin County for the installation of an electric plant to supply electricity to light the court house, county morgue, Memorial Hall and the infirmary buildings.

FINDLAY, OHIO.—The Modern Lt. & Pwr. Co., recently incorporated with a capital stock of $10,000, it is reported, is planning to build an electric-light plant to supply the local demand. R. C. Bishop, P. D. Elsea and E. B. Newman are interested in the company.

GOMER, OHIO.—An election will soon be held to submit a proposal to issue bonds for the installation of a municipal electric-light plant to the voters.

HAMDEN, OHIO.—Bonds issued for the installation of a municipal electric-light plant in Hamden, it is reported, have been sold.

LISBON, OHIO.—The New Lisbon Gas Co. has applied to the Public Utilities Commission for permission to issue $25,000 in bonds, the proceeds to be used for retiring outstanding bonds and for extensions to electric plant, to cost about $15,000.

MIDDLEPORT, OHIO.—The Mutual El. Co., of Middleport, recently organized with a capital stock of $10,000, is planning to install an electric distributing system in Middleport. Electricity to operate the system, it is understood, will be obtained from the Floodwood plant. O. E. Harrison and others are interested.

MILLERSBURG, OHIO.—The Public Utilities Commission has granted the Citizens' Lt. & Pwr. Co., of Millersburg, permission to issue $16,000 in capital stock, the proceeds to be used to purchase the property and holdings of the Millersburg El. Lt. Co. The company was also authorized to issue $10,000 in bonds, the proceeds to be used for extensions and improvements to the plant and system.

NEW BREMEN, OHIO.—The Village Council has granted the Western Ohio Trac. Co. a franchise to extend its high-tension transmission lines along several streets in this town. Arrangements have been made by the company with the village of Fort Laramie to furnish electricity for lighting purposes. In order to furnish the service the company will erect a transmission line from its power house at St. Mary's. The headquarters of the company are in the New England Building, Cleveland.

OAKWOOD, OHIO.—Work has begun on the installation of an electric-light plant in Oakwood. The street-lighting system will consist of 20 100-watt incandesdent lamps. A. D. Friend is reported interested in the project.

SHAKER HEIGHTS, OHIO (not a post office).—The Village Council has awarded a contract to the Cleveland El. Illg. Co., of Cleveland, for lighting the streets of the village for a period of ten years. The contract calls for 200 lamps at $49.80 each per year.

SOLON, OHIO.—The Washington Gas & El. Co., of Washington C. H., it is reported, has submitted a proposal to the Village Council to supply electricity in Solon. G. N. Clapp is manager of the company.

TWINSBURG, OHIO.—The Northern Ohio Lt. & Trac. Co., of Akron, is reported to be contemplating extending its transmission lines to Twinsburg to supply electrical service there.

WINDHAM, OHIO.—The Windham El. Co., recently incorporated with a capital stock of $10,000, contemplates the construction of a small electric-lighting plant in Windham. F. H. Walden, F. A. Eberwine and others are interested in the project.

DANVILLE, KY.—The City Council has contracted with the Danville El. Lt. Co. for the erection of lamp standards on portions of Main, Maple and Walnut Streets. The Council, it is understood, contemplates replacing the arc lamps now in use in the residential district with the same style lamp standards.

LIVERMORE, KY.—The Smith Cooperage Co., of Livermore, has sold its electric plant to W. S. Trunnell and A. M. Hackett, who have organized a new company under the name of the Public Service Co. Within the next three months the Pub. Ser. Co. expects to purchase one cold-water pump, having a capacity of 500 gal. per minute. The company has recently placed an order with the General Electric Co. for 40 5-amp. and four 10-amp meters. Arrangements are being made by the company to furnish a day service in three months.

SOMERSET, KY.—The Kentucky Utilities Co., of Somerset, is planning to extend its transmission lines to Burnside, a distance of 7 miles.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, 700-910 South Michigan Avenue, Chicago, until Feb. 4, for pole erection and line construction in the streets of that city. For details see proposal columns. Thomas A. Smyth is president of board of trustees.

COLLINSVILLE, ILL.—The power plant of the Southern Illinois Lt. & Pwr. Co. in Collinsville is being remodeled to provide space for the high-tension equipment for the new 33,000-volt transmission line to be erected to Carbon and O'Fallon. A new 400-hp boiler will also be installed in this plant.

DECATUR, ILL.—The Board of Local Improvements is contemplating the installation of an ornamental street-lighting system to cost about $7,000. The present plans provide for the erection of 150 ornamental standards mounted with a 100-watt lamp, maintained by underground wires. Not yet decided when contracts will be let. Jerome J. Heger is city clerk.

ELGIN, ILL.—At a special election the proposal to install a municipal electric-lighting plant was carried. Complete plans and specifications for it have been prepared and have been approved by the City Council. An injunction was filed against the city in the Circuit Court and appealed to the Illinois Supreme Court. The city is now awaiting a decision.

HILLSBORO, ILL.—The Southern Illinois Lt. & Pwr. Co. is rebuilding its 16,500-volt transmission line to the towns of Irving, Witt, Butler, Raymond, Harvel and Morrisville, and is changing the main line between the Hillsboro and Morrisville generating stations from single-phase to three-phase.

HOOPESTON, ILL.—The city of Hoopeston, we are informed, does not contemplate the installation of a municipal electric-lighting system at present, as reported in the issue of Jan. 16.

NEW HOLLAND, ILL.—A company has been organized by local business men, under the name of the New Holland Lt. & Pwr. Co., to supply electricity in New Holland. The company is capitalized at $6,000 and proposes to purchase energy to operate its system from the McKinley interests. Work has not yet been started on the plant.

MADISON, WIS.—The Wisconsin Railroad Commission has authorized the Madison Gas & El. Co. to issue $650,000 in bonds, to be sold at not less than 90, to provide funds for extensions and improvements.

AUBURN, IA.—The City Council is considering the installation of a municipal electric-lighting system in Auburn.

BRIGHTON, IA.—Preliminary arrangements, it is reported, are under way tor the installation of a municipal electric-lighting system in Brighton. Electricity to operate the system will probably be obtained from the electric plant in Washington.

FAYETTE, IA.—The municipal electric-lighting plant has been purchased by C. Miller & Sons, of Clermont. Electricity for operating the local system will be supplied from the hydroelectric power plant at Clermont. When connections are completed a 24-hour service will be furnished in Fayette.

FORT DODGE, IA.—The Central Iowa Lt. & Pwr. Co., of Fort Dodge, is reported to be contemplating extensions and improvements to its power plant in Fraser, at a cost of about $100,000.

GRAND JUNCTION, IA.—The Iowa Ry. & Lt. Co., of Cedar Rapids, which recently purchased the local electric-light plant, owned by the G. W. Nicholson Co., expects to erect a high-tension transmission line from Perry to Grand Junction. Electricity to operate the system will be supplied from the plant at Boone.

IMOGENE, IA.—Plans are being considered by the City Council for the installation of a municipal electric-lighting plant. Electricity to operate the system will probably be secured from the Shenandoah plant.

KALONA, IA.—Steps have been taken, it is reported, to organize a company in Kalona to establish an electric-lighting plant. The company will be capitalized at $10,000 and will ask for a franchise here.

LAKE CITY, IA.—Preliminary plans, it is reported, are being prepared for the installation of a municipal electric-lighting system in Lake City.

MASON CITY, IA.—The extension of the lighting system on Powder Street and on other streets, to be owned by the municipality, is reported to be under consideration.

RICHLAND, IA.—The installation of a municipal electric-lighting plant in Richland is reported to be under consideration.

SCHLESWIG, IA.—The city of Schleswig has appropriated $16,000 for the installation of a municipal electric-lighting plant.

KNOBNOSTER, MO.—Preparations are being prepared by the Standard Engineering Co., Republic Building, Kansas City, Mo., for the construction of an electric-light plant in Knobnoster, to cost about $15,000. Bids will be asked for equipment about Feb. 15.

NEW HAVEN, MO.—A committee has been appointed by the town of New Haven to investigate the question of establishing a municipal electric-light plant here.

POPLAR BLUFF, MO.—Preparations are being made by the city of Poplar Bluff for the installation of a municipal electric-light plant, for which bonds to the amount of $75,000 were voted in March, 1914. Bonds

will soon be offered for sale and electrical equipment purchased. Edwin C. Thomes is engineer.

GRAND FORKS, N. D.—Bids will be received by the city of Grand Forks until March 1 for laying underground conduits and installing lamp-posts and extension to ornamental street-lighting system. W. H. Alexander is city auditor.

EDGAR, NEB.—Plans are being prepared for remodeling the municipal electric-lighting plant.

ST. PAUL, NEB.—The proposal to issue $23,000 in bonds for the installation of an electric-lighting plant and water-works system is under consideration. The plans provide for pumping station, steam engine, electrical machinery, electroliers in the business part of the city, etc.

FRANKFORT, KAN.—The organization of a new company to take over the local electric-light plant is under consideration. The plans include the erection of a transmission line to secure electricity from the plant of the Marshall County Pwr. & Lt. Co., of Blue Rapids. It is also proposed to establish an ice factory in connection with the electric plant.

GARDNER, KAN.—A proposal has been submitted to the City Council, it is reported, by the Automatic El. Lt. Co., of Kansas City, Mo., for the installation of a municipal electric-lighting plant in Gardner.

GARNETT, KAN.—A decision handed down by Judge Smart in the District Court specifies that the city of Garnett shall pay $12,960 to J. Q. McAfee for the local electric-light plant. Bonds to the amount of $15,000 were authorized some time ago for the purchase or construction of a municipal electric-light plant.

KANSAS CITY, KAN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 1 for a hydraulic freight lift, pumping plant, etc., in the United States post office in Kansas City, Kan. For details see proposal columns.

OTTAWA, KAN.—Plans are being considered by the Franklyn Retailers' Association for the installation of an ornamental street-lighting system on the principal streets of the city.

PAOLA, KAN.—The City Council will soon award contract for the installation of an ornamental lighting system on Peoria Street. Estimates have been submitted to the Council by Herbert Stockwell, city engineer, of the cost of erecting ornamental lamps on South Pearl Street and South Silver Street and all streets for one block from the public square.

Southern States

ATLANTA, GA.—The trustees of the Georgia School of Technology, it is reported, will build the power laboratory contemplated last year, at a cost of about $200,000, including machinery costing $100,000 donated by Northern corporations.

GRIFFIN, GA.—Within the next three or four months the Towaliga Falls Pwr. Co. expects to build a substation to be equipped with six 500-kva, 26,000-volt, 60-cycle, single-phase, oil-cooled transformers and two 26,000-volt switches and switchboard. F. Mayes is superintendent.

BONIFAY, FLA.—The Bonifay Lt. & Wtr. Co. is planning to construct a water and light plant, to cost about $8,000. The plans provide for a development of from 60 hp to 70 hp. The contract for the power house, it is understood, has been awarded.

COVINGTON, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 20, for the construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Covington, Tenn. Drawings and specifications may be obtained from the above office or from the custodian of site at Covington. O. Wenderoth is supervising architect.

BIRMINGHAM, ALA.—The People's Hydro-Electric Pwr. Co., recently incorporated with a capital stock of $20,000, is planning a development on the Coosa River, passing over Ten Islands, Whisenant and Leota Shoals. The plans provide for the construction of a dam and power house at Lock 2, near Wood's Island, under the authority and supervision of the federal government. R. H. Cobb is president and manager and S. H. Richardson secretary, both of Birmingham.

WETUMPKA, ALA.—The Wetumpka Lt. & Wtr. Pwr. Co. expects to purchase within the next 30 days one carload of 30-ft. poles. S. J. McMorris, Jr., is superintendent.

BATESVILLE, ARK.—A new 160-kva, three-phase turbo-generator, with condenser and switchboard, is being installed in the municipal electric-light plant. W. H. Walkup is superintendent.

BLYTHEVILLE, ARK.—We are advised that no additions are being made to the electric-lighting plant, owned by Hollipeter & Jontz. Improvements are being made to the building and additional ice machinery is being installed. Reported in the issue of Jan. 16 that the output of ice and electric plants would be doubled.

HEBER SPRINGS, ARK.—Within the next six months the Heber Springs Lt. Co. expects to purchase two 12-in. by 30-in. Corliss engines, two 60-kw generators, complete switchboard equipment for same, one boiler (66 in. by 16 ft.) with rocker grates, one heater and two separators. The company expects to erect within the next 30 days line for addition to street-lighting system consisting of 25 Mazda lamps of 60 cp, making a total of 65. H. N. Case is manager.

RISON, ARK.—The City Council is contemplating the installation of a municipal electric-lighting plant and water-works system, to cost about $25,000. A. C. Moore, of Joplin, Mo., is engineer.

SEARCY, ARK.—A franchise has been granted to H. E. Hill, of Searcy, to construct and operate an electric railway between here and Kensett, a distance of about 4 miles, and also over some of the streets in this town. The power plant for the proposed railway will be in Searcy.

SILOAM SPRINGS, ARK.—Within the next three months the Electric Light and Water Commissioners expect to purchase one 125-hp boiler. R. L. Neely is superintendent.

PINEVILLE, LA.—The Town Council has granted the Electric Light Department of Alexandria City a franchise to supply electricity in Pineville for a period of 25 years. The transmission lines connecting the two cities will be carried across the Red River, either on the traffic bridge or on poles.

RINGLING, OKLA. (not a post office).—The installation of an electric-lighting plant in Ringling is reported to be under consideration. H. E. Foster and associates, of Ardmore, are reported interested in the enterprise.

MATADOR, TEX.—L. B. Hubbard & Brother, it is reported, are installing an electric-light and power plant in Matador.

PRAIRIE VIEW, TEX.—An appropriation of $200,000 has been asked for improvements to the Prairie View Normal School, which include a steam and electric plant, to cost about $30,000; laundry building, $20,000, and water mains for water protection, $12,600.

SNYDER, TEX.—E. F. Renken, who recently purchased the local electric light and power plant, it is reported, contemplates the installation of new machinery, including an oil engine. The cost of the proposed improvements is estimated at $15,000.

Pacific States

TACOMA, WASH.—The Molander-Hawaiian Pwr. Co., of Tacoma, Wash., a subsidiary of the Molander Pwr. Co., of California, is contemplating the construction of an electric power plant. The proposed plant will be driven by a wave-motor machine (about 7500 hp); the installation of a 5000-kw generator is also under consideration. The location of the plant is not yet decided upon.

SALEM, ORE.—The installation of a municipal electric-lighting plant in Salem is under consideration. According to estimates prepared the cost would be from $200,000 to $250,000.

FRESNO, CAL.—A resolution ordering work and calling for bids for the proposed electrolier system in Fresno has been passed by the City Council.

PALO ALTO, CAL.—The city of Palo Alto has recently installed a 300-hp Koerting Diesel engine (four cylinders, four-cycle, horizontal) directly connected to a Fort Wayne generator, and may possibly install another Diesel engine if the present one is satisfactory. Within the next 12 months the city expects to purchase transformers, poles, wire, meters, incandescent lamps and heating and cooking apparatus. A. V. Youens is city electrician.

SAN JACINTO, CAL.—Within the next three months the Southern Sierras Pwr. Co., of San Jacinto, expects to erect approximately 5 miles of 2200-volt distribution lines to supply electricity in a territory heretofore without electrical service. During the past three months the company has installed an outdoor transformer bank of 150 kw, to reduce the voltage from 33,000 volts to 2200 volts. R. B. Mateer is superintendent and commercial agent.

BOISE, IDAHO.—The cost of installing an electric lighting system on the South Side is estimated at $4,639. The City Council, it is reported, will ask for bids for material and installing the same in the near future.

BOISE, IDAHO.—The property of the Idaho-Oregon Lt. & Pwr. Co. has been taken over by the Electric Investment Co., a Delaware corporation, organized for the purpose of purchasing the system. The new company, it is understood, will make improvements to the property and complete the Oxbow plant.

KAMIAH, IDAHO.—Plans are being considered by the Rawson Works Lumber Co., of Kamiah, for the installation of an electric-lighting plant here. Electricity to operate the system is to be supplied by the plant in its planing mill, situated about 1 mile north of the town.

TWIN FALLS, IDAHO.—Reversing the decision handed down by it Nov. 7, 1914, the Public Utilities Commission of the State of Idaho has granted the Idaho Pwr. & Lt. Co. a certificate of convenience and necessity in the Twin Falls section in competition with the Great Shoshone & Twin Falls Pwr. Co. The Idaho Pwr. & Lt. Co. has taken over the property and rights of the Beaver River Pwr. Co., which has hydroelectric plants on the Beaver River and the Malad River.

GREEN RIVER, UTAH.—The contract for the construction of the municipal electric-light and power plant has been awarded to the Green Construction Co., of Tooele City, at $20,000. The proposed plant will be situated on the Green River, 7 miles from the city, and will supply electricity in Green River, Elgin and other towns throughout the valley. Energy will be supplied especially for irrigation pumping plants.

PAROWAN, UTAH.—Steps have been taken toward the organization of a company for the purpose of installing an electric light and power plant in Parowan. It is proposed to turn the plant over to the city when it is ready to operate it.

CASA GRANDE, ARIZ.—Application has been made to the town of Casa Grande by F. H. Brackett, Colin Cameron and Frank H. Hitchcock for a franchise to construct and operate an electric-lighting plant here. The plans provide for the erection of a plant to cost about $100,000 and may include an ice factory and water-works system.

JEROME, ARIZ.—The Upper Verde Pub. Utilities Co., of Jerome, expects to purchase within the next 30 days a complete new arc-lamp street-lighting system for Jerome. T. C. Roberts is chief engineer.

PRESCOTT, ARIZ.—Within the next three months the Arizona Pwr. Co. of Prescott expects to erect 3 miles of 45,000-volt transmission line and to install a substation at Carlisle, with an output of 2000 hp. M. V. Watson is manager.

SPRINGER, N. M.—Charles O'Malley, of the Las Vegas Lt. & Pwr. Co., of Las Vegas, is contemplating the installation of an electric-light plant in Springer.

WHITE OAKS, N. M.—The Altos Lt. & Pwr. Co., of White Oaks, recently incorporated with a capital stock of $150,000, is planning to erect a transmission line from the mines at White Oaks to Carrizozo. The incorporators are Allen A. Lane, Edward L. Queen, David L. Jackson and Elmer E. Slaughter.

Canada

HAWKESBURY, ONT.—The Hawkesbury El. Lt. & Pwr. Co. has issued $125,000 in bonds, the proceeds to be used to take up outstanding indebtedness and to finish a second development on the Rouge River, 5 miles above the present plant. The company furnishes electricity in Hawkesbury, Vankleek Hill and Calumet, and also for lighting the Greenville Canal. The service will probably be extended to Alexandria upon completion of the new plant.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 24 for material for pumping plant of Dry Dock No. 1, Balboa terminals. Blanks and general information relating to this circular (No. 891) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 12, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,124,249. MANUFACTURE OF ELECTRIC CABLES; G. A. Anderberg, Oak Park, Ill. App. filed May 2, 1914. Method of obtaining uniformity in twisted conductors.

1,124,258. RING-WELDING MACHINE; A. M. Bates, Chicago, Ill. App. filed Nov. 13, 1911. Electrical welding of wire rings.

1,124,277. SYSTEM OF DISTRIBUTION; J. Bijur, New York, N. Y. App. filed Nov. 18, 1911. Controlling the connection of the generator with the load.

1,124,280. ELECTRIC-MOTOR-CONTROLLING MEANS; J. C. Brackett, Chicago, Ill. App. filed March 15, 1911. For web printing presses.

1,124,290. CURRENT-CONTROLLING DEVICE FOR ELECTRIC CIRCUITS; G. A. Burnham, Saugus, Mass. App. filed Nov. 9, 1910. Excess of current above a maximum demand is visually indicated.

1,124,303. ELECTRIC FLATIRON; W. H. Dalton, Salem, Mass. App. filed April 10, 1912. Reversible iron with two ironing surfaces either one of which can be used.

1,124,314. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; F. R. McBerty, Antwerp, Belgium. App. filed June 3, 1913. Speed at which a given connection can be made is increased.

1,124,315. PROCESS FOR ELECTROLYTICALLY REFINING TIN; G. Michaud and E. Delasson, Montreuil, France. App. filed Sept. 17, 1912. Electrolyte of protochloride of tin.

1,124,333. MANUFACTURE OF LIGHT HYDROCARBONS OR THE LIKE; P. Sabatier and A. Mailhe, Toulouse, France. App. filed March 31, 1914. Vapors of the hydrocarbons passed over metals maintained at red heat by passage of electric current.

1,124,352. ELECTRICAL INDICATOR FOR MAIL BOXES; R. Stegemann and A. Johannes, Two Rivers, Wis. App. filed April 17, 1914. Sounds alarm and operates visual indicator.

1,124,401. TELEPHONE RECEIVER; H. C. Egerton, Passaic, N. J. App. filed Oct. 5, 1912 Loud-speaking .

1,124,410. FIRE ALARM; F. Franek, Chugwater, Wyo. App. filed Jan. 10, 1914. Embodies a celluloid ball carrying a wick.

1,124,413. TRANSMITTER; H. Gernsback, New York, N. Y. App. filed May 15, 1913. Attached to telephone in vertical position and without using binding screws.

1,124,428. TROLLEY-WHEEL GUARD; J. C. Hanson, Moville, Iowa. App. filed June 20, 1914. Mechanical structure of guard.

1,124,456. DEVICE FOR SECURING ARMATURE COILS; P. Kennedy and J. A. Misland, Brooklyn, N. Y. App. filed Feb. 8, 1911. Circumferential wrapping for ends of coils.

1,124,463. INDICATING DEVICE FOR MOTOR VEHICLES; H. Kramer, New York, N. Y. App. filed April 23, 1914. For instructing chauffeur; also provides a rear signal.

1,124,470. INTERRUPTER FOR ELECTROMAGNETIC RECIPROCATING DEVICES; A. Le Blanc, New York, N. Y. App. filed Sept. 28, 1910. Make-and-break construction for riveting hammers and the like.

1,124,488. SEMI-MECHANICAL TELEPHONE-EXCHANGE SYSTEM; F. R. McBerty, New Rochelle, N. Y. App. filed July 30, 1909. Improved sending apparatus.

1,124,525. MECHANICAL BELL-RINGING DEVICE; H. Von Reppert, Columbus, Ohio. App. filed Dec. 23, 1913. Friction clutch and motor control for imparting the swinging movement to the bell.

1,124,541. THERMOSTAT; H. D. Singer and H. V. D. Pratt, Hospital, Ill. App. filed Sept. 11, 1911. Maintains vacuum in the thermometer tube regardless of adjustment of the upper terminal.

1,124,547. MOUTHPIECE FOR TRANSMITTERS; L. Steinberger, New York, N. Y. App. filed Oct. 18, 1910. Has improved acoustic characteristics.

1,124,548. ELECTRIC-HEATING ATTACHMENT FOR RADIATORS; T. A. Steller, Houghton, Mich. App. filed Sept. 11, 1913. Can be inserted in the base of an ordinary steam or hot-water radiator.

1,124,555. METHOD OF EXHAUSTING VESSELS; C. J. Thatcher, Upper Nyack, N. Y. App. filed March 11, 1910. By non-volatilized and inexpensive gas absorbents.

1,124,560. PROCESS FOR SATURATING UNSATURATED FATTY ACIDS AND THEIR GLYCERIDES BY COMBINING THEM WITH-HYDROGEN; B. Utescher, Hamburg, Germany. App. filed Feb. 10, 1913. Silent electrical discharge maintains catalytic substance permanently active.

1,124,561. COIN BOX; H. I. Utter, Chicago, Ill. App. filed Feb. 8, 1913. Deposit of coin in the coin box controlled from either the main or extension telephone.

1,124,580. METHOD OF AND MEANS FOR LOCALIZING SOUND REPRODUCTION; E. H. Amet, Redondo Beach, Cal. App. filed July 3, 1911. For moving pictures.

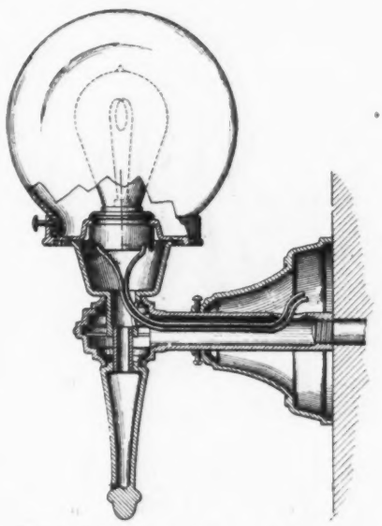
1,124,598. TELEGRAPHY; P. E. Delany, South Orange, N. J. App. filed Dec. 28, 1908. For distribution of news among a plurality of way stations

1,124,599. ELECTRIC CIRCUIT-PROTECTING APPARATUS; G. R. Fessenden, Jr., Lancaster, N. Y. App. filed Oct. 1, 1913. For alternating-current induction motors

1,124,608. AUTOMATIC TELEPHONE SYSTEM; G. Grabe, Berlin, Germany. App. filed Feb. 8, 1913. Selector terminals not arranged according to the decimal system.

1,124,617. ELECTRIC SIGNALING APPARATUS AND CIRCUITS THEREFOR; F. B. Herzog (deceased), New York, N. Y. App. filed April 8, 1889. For hotels or telephone systems.

1,124,624. RETRIEVING TROLLEY; C. E. Lang, Los Angeles, Cal. App. filed Jan. 2, 1912. Mechanical structural improvements; occupies minimum space.



1,124,939—Electric-Lamp Fixture

1,124,630. DYNAMO-ELECTRIC MACHINE; H. Lippelt, New York, N. Y. App. filed Oct. 13, 1909. Sparking obviated at all loads.

1,124,632. ELEVATOR SIGNALING SYSTEM; W. B. Lucas, River Forest, Ill. App. filed Feb. 25, 1910. "Up and down" signals announce in advance arrival of car at floor.

1,124,653. OUTLET OR JUNCTION BOX; J. C. Phelps, Springfield, Mass. App. filed May 14, 1913 Improvements in box-and-cover construction.

1,124,666. ELECTRIC LOCK; W. A. Schutzmann, New Iberia, La. App. filed Oct. 28, 1913. For toilet doors of railway cars; operative only when train is in motion.

1,124,676. AUTOMOBILE BODY; J. T. Trumbule, Saginaw, Mich. App. filed April 29, 1912. Wiring located in conduits formed in the body.

1,124,678. CIRCUIT CONTROLLER; T. Varney, Pittsburgh, Pa. App. filed Feb. 1, 1912. Auto-starter for induction motors.

1,124,680. SELECTIVE SIGNALING DEVICE; J. A. Wotton, Cranford, N. J. App. filed Aug. 31, 1911. Selector contact structure.

1,124,681. LAMP SIGNAL APPARATUS FOR AUTOMOBILES; J. T. Wright, Metuchen, N. J. App. filed Oct. 17, 1912. Details of switch which controls the signals.

1,124,683. PERCOLATOR; T. Abtmeyer, Wilkinsburg, Pa. App. filed June 5, 1913. Has heating member with both inner and outer heating surfaces.

1,124,704. ELECTRIC TYPEWRITING TELEGRAPH APPARATUS; G. C. Clark, Fruitvale, Cal. App. filed Feb. 28, 1910. Combined transmitter, receiver and recorder.

1,124,712. TROLLEY HANGER; C. H. Davis, Pittsburgh, Pa. App. filed Jan. 7, 1911. Arm which supports trolley wire is vertically yieldable.

1,124,732. CONTROLLER FOR ELECTRIC MOTORS; F. W. Harris, Wilkinsburg, Pa. App. filed Sept. 26, 1910. Motor-line switch can be closed only under proper voltage and phase conditions.

1,124,751. SENDER; J. A. Kropp, Newark, N. J. App. filed Sept. 25, 1913. Includes a speed-controlled motor mechanism.

1,124,796. ELECTROMAGNETICALLY OPERATED DEVICE; H. G. Pape, New York, N. Y. App. filed May 27, 1914. Telephone "drop."

1,124,799. SIGNALING SYSTEM; C. H. Pool, Binghamton, N. Y. App. filed Jan. 12, 1914. Special fire-alarm system.

1,124,809. CIRCUIT-CONTROLLING APPARATUS; F. W. Roller, East Orange, N. J. App. filed Oct. 18, 1911. Shown applied to a metal-melting crucible.

1,124,814. CONTROLLING DEVICE FOR AUTOMATIC MUSICAL INSTRUMENTS; J. W. Scharold, Cincinnati, Ohio. App. filed Aug. 30, 1910. "Slot machine."

1,124,832. TIME-LIMIT CIRCUIT-BREAKER; C. C. Badeau, Bethlehem, Pa. App. filed Aug. 18, 1908. Time of operation is dependent upon the amount of overload.

1,124,849. ELECTRICALLY ENERGIZED HEATER; C. B. Brush, Joliet, Ill. App. filed Sept. 24, 1913. For eliminating the static electricity from paper on printing presses.

1,124,865. MULTIPLE LIGHTNING ARRESTER; C. E. Cox, Eaton, Ohio. App. filed Oct. 25, 1912. Mounted on cross-arm and takes care of all lines carried by that cross-arm.

1,124,904. ARTIFICIAL LINE; R. S. Hoyt, Brooklyn, N. Y. App. filed April 30, 1913. Pre-computed resistance and reactance units.

1,124,910. ELECTRICAL HEATER; E. D. Johnson and G. A. Cathey, Klamath Falls, Ore. App. filed Oct. 15, 1914. In form of plug adapted to be connected with an automobile radiator.

1,124,913. SIGNALING SYSTEM PARTICULARLY FOR ARTILLERY PURPOSES; P. Kaminski, Berlin, Germany. App. filed May 20, 1911. Two transmitters move through different distances when the one is driven by the other.

1,124,939. ELECTRIC-LAMP FIXTURE; T. Nelsen, Chicago, Ill. App. filed May 27, 1914. Waterproof side bracket for outdoor use.

1,125,004. POTENTIAL STARTER FOR ALTERNATING-CURRENT MOTORS; H. W. Cheney, Norwood, Ohio. App. filed June 7, 1905. Adapted for use on either two-phase or three-phase.

1,125,028. ELECTRIC VAPORIZER; F. Kuhn, Detroit, Mich. App. filed April 5, 1912. In form of a gasket adapted to be interposed between the abutting sections of a gas-engine intake.

1,125,030. REAR INDICATOR FOR VEHICLES; G. A. Laubersheimer, Los Angeles, Cal. App. filed Nov. 24, 1913. Semaphore arm shifted by magnets.

UNITED STATES PATENTS ISSUED JAN. 19, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,125,039. ELECTRIC MOTOR; W. J. Beuroth, Columbus, Ohio. App. filed Dec. 7, 1907. Improvements in armature shaft, bearings and casing structure.

1,125,059. SPARKLESS THERMOSTAT; G. P. Carroll, Bridgeport, Conn., and P. N. Roehrich, Jersey City, N. J. App. filed July 14, 1910. Contacts within a closed rocking device which is shifted by the thermostatic arm.

1,125,077. CIRCUIT-BREAKER; R. R. Dunlop, Columbus, Ohio. App. filed Sept. 23, 1910. For mine locomotives.

1,125,080. STORAGE-BATTERY-CHARGING SWITCH FOR AUTOMOBILES; E. Eisemann, Stuttgart, Germany. App. filed Nov. 9, 1911. Includes contact-controlling armature which oscillates in polarized fields.

1,125,086. MAKING ARSENIC ACID AND ARSENICAL COMPOUNDS; G. P. Fuller, Niagara Falls, N. Y. App. filed June 1, 1914. Electrolyzes aqueous solution of alkali metal kalide containing arsenious oxide in suspension.

1,125,121. SUPPORT FOR INCANDESCENT-LAMP FILAMENTS; A. S. Knight, Newark, N. J. App. filed July 19, 1909. Tubular lamp with straight filament extending from end to end.

1,125,143. LAMP LOCK; W. E. McLaughlin, Middletown, Ohio. App. filed Feb. 7, 1914. Includes a rotatable screw socket which can be held when lamp is to be removed.

1,125,152. CABLE-REELING MECHANISM FOR ELECTRIC LOCOMOTIVES; N. A. Newdick, Columbus, Ohio. App. filed Nov. 29, 1905. Has a friction clutch which can operate as a friction brake.

1,125,195. STARTING DEVICE; A. Simon, Milwaukee, Wis. App. filed June 12, 1907. For alternating-current motors.

1,125,201. REINFORCED-CONCRETE CELL FOR THE ELECTROLYSIS OF SALT, ETC.; N. Statham, Yonkers, N. Y. App. filed Nov. 1, 1913. For producing caustic soda, chlorine, etc.

1,125,208. PROCESS FOR PRODUCING REACTIONS IN GASES AT HIGH TEMPERATURES AND APPARATUS FOR PRACTISING THE SAME; L. L. Summers, Chicago, Ill. App. filed June 14, 1913. Synthesis of gaseous compounds by use of electric arc.

1,125,223. MEANS FOR COOLING VACUUM TUBES; H. F. Waite, New York, N. Y. App. filed Sept. 22, 1913. Circulates a cooling gas around the cathode tip and neck.

1,125,242. AUTOMATIC SWITCH; J. L. Woodbridge, Philadelphia, Pa. App. filed Dec. 2, 1911. For battery charging.

1,125,267. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed Sept. 22, 1911. Battery charging, including control means having differentially wound coils.

1,125,273. KEY-CONTROLLED REGISTERING APPARATUS; A. F. Dixon, Newark, N. J. App. filed May 17, 1912. Selector controlling arrangement for semi-automatic telephone systems.

1,125,279. ELECTRO-RESPONSIVE REGULATOR; J. B. Entz, Cleveland, Ohio. App. filed Oct. 28, 1910. Includes a movable part controlled by the algebraic sum of the spring tensions of two controlling springs.

1,125,312. INTEGRATING ELECTRICITY METER; C. I. Hall, Chicago, Ill. App. filed Aug. 24, 1911. Indicates and records time and amount of maximum consumption of energy.

1,125,321. SECONDARY OR STORAGE BATTERY; C. Hodge, Radnor, Pa. App. filed May 16, 1912. The plates are connected by "burning."

1,125,349. MAGNETO; O. H. Lemke, Milwaukee, Wis. App. filed July 2, 1913. Reversal of the engine does not impair the efficiency of ignition.

1,125,353. TROLLEY GUARD; J. A. Love, Roanoke, Va. App. filed Sept. 8, 1914. Pull on trolley cord opens the guard.

1,125,370. CONNECTOR; E. C. G. Mueller, Elizabeth, N. J. App. filed Aug. 28, 1913. Plug locked in socket when connection is made.

1,125,424. AUDIPHONE-TRANSMITTER STAND AND SOUNDING BOARD; C. E. Williams, Chicago, Ill. App. filed Jan. 14, 1911. Includes two transmitter-carrying leaves inclined from the vertical.

1,125,462. TESTING APPARATUS; C. N. Cahusac, New York, N. Y. App. filed Dec. 12, 1913. Apparatus box for wiremen's fault-locating sets.

1,125,476. SYSTEM OF ILLUMINATING BY LUMINESCENT TUBES; G. Claude, Paris, France. App. filed Nov. 9, 1911. Tube containing previously purified neon.

1,125,487. COMBINED RAILWAY ELECTRIC-TRACTION, TELEGRAPH AND SIGNAL SYSTEM; A. V. T. Day, New York, N. Y. App. filed Sept. 15, 1906. Embodies one continuous and one divided track rail.

1,125,488. RAILWAY SIGNALING SYSTEM; A. V. T. Day, New Rochelle, N. Y. App. filed Aug. 28, 1908. Separate alternating-current generators feed the track rails at intervals.

1,125,489. ELECTROMAGNET STRUCTURE; W. W. Dean, Elyria, Ohio. App. filed Sept. 8, 1904. Mounting and adjustment of armature of telephone ringer.

1,125,490. ELECTRICAL SIGNALING; W. W. Dean Elyria, Ohio. App. filed May 19, 1905. Harmonic telephone signaling in which reed is adjusted to respond to its own natural frequency.

1,125,491. PROTECTIVE DEVICE; W. W. Dean, Elyria, Ohio. App. filed May 19, 1905. "Heat coil" for protecting against "sneak currents" in telephone work.

1,125,492. SIGNALING DEVICE FOR POLYSTATION CIRCUITS; W. W. Dean, Elyria, Ohio. App. filed Aug. 9, 1905. Polarized ringer with armature held neutral by a strong spring.

1,125,493. HARMONIC SIGNALING DEVICE FOR TELEPHONE SYSTEMS; W. W. Dean, Elyria, Ohio. App. filed Sept. 9, 1905. Structural details.

1,125,494. HARMONIC SIGNALING DEVICE FOR TELEPHONE SYSTEMS; W. W. Dean, Elyria, Ohio. App. filed Sept. 9, 1905. Length, tension and mass of clapper rod determines period of ringer.

1,125,495. HARMONIC SIGNALING DEVICE FOR TELEPHONE SYSTEMS; W. W. Dean, Elyria, Ohio. App. filed Sept. 9, 1905. Armature secured upon a prismatic spring.

1,125,496. WIRELESS-TELEPHONE TRANSMITTING SYSTEM; L. De Forest, New York, N. Y. App. filed Sept. 17, 1910. Employs slowly damaged radiated waves.

1,125,518. SUPPORT FOR TROLLEY WHEELS; A. W. Hampshire, Haddon Heights, N. J. App. filed April 29, 1914. Vertically yieldable pair of toggle members.

1,125,520. CIRCUIT-BREAKER; F. W. Harris, Wilkinsburg, Pa. App. filed Jan. 10, 1908. Compensates for the wearing away of the engaging contact members.

1,125,541. INHERENT POWER RETURN SIGNALING DEVICE; W. K. Howe, Rochester, N. Y. App. filed March 6, 1911. Semaphore system.

1,125,907—Combination Gas and Electric Lamp

1,125,579. TELEPHONE-EXCHANGE SYSTEM; F. R. McBerty, New Rochelle, N. Y. App. filed March 1, 1911. Automatic line selection.

1,125,580. TROLLEY; I. E. McCracken, Pittsburgh, Pa. App. filed May 13, 1914. Lies close to car roof when pulled down.

1,125,605. PLUG FOR INCANDESCENT ELECTRIC LAMPS; W. C. Tregoning, Cleveland, Ohio. App. filed May 13, 1912. Constructed so that the cord will untwist when hand is removed from plug.

1,125,608. LIGHTING FIXTURE; F. W. Wakefield, Vermilion, Ohio. App. filed Sept. 9, 1912. May be supplied by the dealer with a selected number of arms.

1,125,612. PLUG FUSE; E. W. Wells, Pittsburgh, Pa. App. filed March 6, 1914. Fuse wire can readily be renewed.

1,125,614. TELEPHONE ATTACHMENT; J. Whitaker, Philadelphia, Pa. App. filed Jan. 30, 1914. Hangs up the receiver when not in use.

1,125,615. EMBEDDING MATERIAL FOR ELECTRICAL HEATING UNITS; S. P. Wilbur, Pittsburgh, Pa. App. filed Nov. 13, 1911. Carbide silicate of soda and water.

1,125,616. EMBEDDING MATERIAL FOR ELECTRICAL HEATING UNITS; S. P. Wilbur, Pittsburgh, Pa. App. filed Nov. 13, 1911. Carbide, silica, silicate of soda and water.

1,125,674. FIRE ALARM; C. B. and M. C. Eastman, Georgetown, Mass. App. filed July 3, 1913. Made compact so as to be installed at any point.

1,125,682. SELECTOR SWITCH; O. F. Forsberg, Yonkers, N. Y. App. filed Jan. 13, 1913. Brush, terminal blocks, frame members, etc.

1,125,694. INCANDESCENT LAMP; A. S. Knight, Newark, N. J. App. filed April 10, 1909. Straight filament with means for maintaining it taut.

1,125,699. ELECTRICAL RECORDER; M. E. Leeds, Philadelphia, Pa. App. filed Nov. 22, 1912. For recording electrical, chemical, mechanical, physical or other quantities. (Fifty-one claims.)

1,125,711. ELECTRICAL MEASURING INSTRUMENT; J. W. Record, Manchester, England. App. filed Dec. 23, 1912. Eliminates the polar-junction magnetic flux.

1,125,715. CIRCUIT-BREAKER FOR MAGNETOS; J. H. Richards, Newark, N. J. App. filed Aug. 26, 1914. Supporting and lubricating the breaker arm.

1,125,717. ELECTRIC REGULATOR; F. E. Ricketts, Derwood, Md. App. filed Nov. 13, 1907. Regulating generator coincides with or opposes field circuit of main generator.

1,125,720. FIRE ALARM; C. E. Rogers, Denver, Col. App. filed March 12, 1913. Interconnected alarm boxes on different floors.

1,125,728. ALTERNATING-CURRENT SYNCHRONOUS DYNAMO-ELECTRIC MACHINE; J. Sachs, Hartford, Conn. App. filed Nov. 27, 1911. Starts and brings into synchronous operation without using starting motor, mechanical power, special windings, etc.

1,125,742. CABLE-SUPPORTING INSULATOR; E. O. Sessions, Chicago, Ill. App. filed Feb. 9, 1912. Two-piece tubular insulator.

1,135,744. INCANDESCENT LAMP; C. F. Scott, Pittsburgh, Pa. App. filed May 19, 1909. Tensioning of straight filament.

1,125,745. CIRCUIT-BREAKER; W. M. Scott, Philadelphia, Pa. App. filed March 27, 1908. Has main and shunt members pivotally mounted independently of each other.

1,125,764. TELEPHONE TRANSMITTER; C. C. Terhune, Platte, S. D. App. filed Oct. 23, 1913. Permanent magnet adapted for attachment to standard instrument.

1,125,783. ELECTRO-POWER PLANT; H. F. Waters, Colorado Springs, Col. App. filed Sept. 24, 1913. Wind-operated driving mechanism cut out when battery is charged.

1,125,815. CONTROLLER FOR ELECTRIC MOTORS; H. W. Cheney, Milwaukee, Wis. App. filed Dec. 29, 1909. For induction motors; controller drum shifts with a snap action.

1,125,816. TROLLEY-WIRE SPLICE; W. Clark, Bulger, and T. Beadling, Carnegie, Pa. App. filed Feb. 18, 1914. Can be lengthened or shortened.

1,125,823. TELEPHONE; F. Q. Dutton, Philadelphia, Pa. App. filed March 22, 1912. Plug for mouthpiece of transmitter.

1,125,832. TELEPHONE REPEATER SYSTEM; J. W. Fry, Seattle, Wash. App. filed April 2, 1913. Voice sounds transmitted from either end of line without interference.

1,125,851. HOTEL CALL BELL; K. Kawano and R. Nishimoto, Seattle, Wash. App. filed April 23, 1914. For calling guests at predetermined times.

1,125,852. MEANS FOR MOUNTING CURRENT DISTRIBUTOR BLOCKS; G. L. Lang, Newark, and A. D. T. Libby, East Orange, N. J. App. filed Aug. 26, 1914. Permits ready attachment to and detachment from the magneto.

1,125,858. CORD REEL FOR VEHICLE LIGHTS; B. E. McCoy and K. Nash, New Harmony, Ind. App. filed May 7, 1913. Trouble lamp with reel.

1,125,859. TROLLEY-WIRE CONNECTOR; C. P. McDonald, Grand Junction, Col. App. filed May 11, 1914. Yields and contracts to compensate for contraction and expansion of trolley wire.

1,125,889. ELECTRICALLY HEATED STEERING RIM; R. S. Smith, Kansas City, Mo. App. filed March 14, 1913. Tubular heater laced to steering wheel.

1,125,900. OZONATOR; A. R. Darling, Indianapolis, Ind. App. filed April 9, 1913. Has a winding exposed to atmosphere so that air can pass thereover.

1,125,907. COMBINATION GAS AND ELECTRIC LAMP; A. H. Humphrey, New York, N. Y. App. filed Sept. 5, 1914. Indirect or semi-indirect type.

1,125,913. ELECTRIC MACHINE; J. B. Roche, Grand Rapids, Mich. App. filed Jan. 21, 1914. For treating for medicinal purposes; mounted in carrying case.

1,125,914. ROTARY CONVERTER AND TRANSFORMER; W. F. Rosebrock. Fargo, N. D. App. filed Aug. 29, 1913. Small and compact; for use upon a motor car.